PROTECTOWIRE®
FireSystem
2000

FIRE DETECTION CONTROL PANEL
OPERATING & MAINTENANCE MANUAL

SIGNALING
UL LISTED
FM APPROVED

An ISO 9001 Registered Company

FM Approvals

IMPORTANT SERVICE NOTICE

When requesting service assistance, or to order parts for this control panel, you are required to provide the **Model Number**, **Drawing Number and Serial Number**. This product information is recorded on the Panel Identification Label located inside the control panel. Please have this information available before calling your Authorized Protectowire Distributor or the Factory.

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www.protectowire.com

FS2000 Series Fire Detection Control Panel
Operating & Maintenance Manual

Part Number MAN-2000

Revision Date: June 1, 2011

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Notice

Testing and maintenance of system controls shall be performed by competent, qualified personnel having jurisdiction over this protective signaling system.

This system may contain detection zones which are assigned to trip release solenoids and/or equipment shut-down. As a deterrent to accidental activation of the release system, the control card module for systems so equipped does not have a system test (alarm simulate) button.

Testing zones with solenoid release circuits and equipment shutdown contacts may be accomplished by use of a jumper wire across the detection/initiating circuit field wiring terminals only after all the solenoid dis-connect switches on the release modules are depressed to the disconnect (down) position and all equipment shutdown contacts are bypassed.

Fire Control Panel must be tested with a fully charged 24 Volt battery set. Failure to do so may result in system failure.

Warning!
Fatal electrical shock and equipment damage may result from failure to remove all power prior to servicing system.

Caution

The Protectowire Co. Inc. designs and manufactures fire protection systems to meet both UL and FM Global criteria for electrical transients introduced on both the power supply side of the system and into the panel from field wiring for initiating device circuits, notification applaince circuits, and other external field routed wiring.

Fire protection systems located in areas subject to lightning strikes, or subject to other severe transients, and electromagnetic interference, should be protected similar to computers and other electronic systems with supplemental surge and filter protection both on the power supply side and on the field wiring for initiating device circuits, notification appliance circuits and other field routed wiring.

Please refer to surge/filter manufacturers, (eg. DITEK 800-753-2345, www.ditekcorp.com) to specify devices for your particular conditions. The National Lightning Safety Institute (www.LightningSafety.com) also provides valuable information regarding the problems and solutions of providing lightning protection including assuring true earth ground conditions.

Lightning strikes, other severe power surges, and EMI/RFI interference, by their nature, are beyond normal design criteria and are outside the warranty for manufacturing defects.

FS2000 Series Fire Detection
Deluge/Preaction Control Panel Information and Specifications

The FS2000 Series of multiple zone fire protection panels is the latest in fire protection from The Protectowire Company, Inc. The standard model provides, as a minimum, 2 (Class A or B) initiating device circuits and the following standard features:

- Expandable (in multiples of two zones)
- Two Supervised Notification Appliance Circuits
- On Board Audible Indicator Silencing
- Lamp and System Trouble Circuit Test
- Ground Fault Detection (not applicable to all systems)
- Alarm Lock-in until Reset
- On Board System Reset Button
- Dry Alarm and Trouble Contacts

- Initiating Device (Detection) Circuit -IDC- ALARM Test
- Monitors up to 5,000 ft. (1,524 meters) of PROTECTOWIRE Linear Heat Detector Cable per circuit
- Any combination of normally open contact devices
- Accommodates up to (30) NS-series #SLR-24, #SIJ-24, #SLR-24H, Detector Identifier - HD-3 Smoke Detectors (per circuit).
- Battery Monitoring, Low or Out of operating specs. (or disconnected)

System Specifications

Primary AC Power	120VAC 50/60Hz 1.75 amp maximum ** see below
Supported Standby Batteries	24VDC 4.5AH minimum to 60AH maximum * see below
Battery Charger	27VDC 1.25 Fast charge, 27.6mA Max trickle charge, 12mA (typical)
Primary System Power	24V FWR by T1, 175VA typical. Greater VA rating as required by system
System Regulated Power	MB and EB type boards provide 12 & 24VDC regulation. RS type boards provide24VDC regulation only
Common Alarm Contacts	3 amps @ 30VDC, resistive load, silenceable
Common Trouble Contacts	1 amp @ 24VDC, resistive load, factory preset as non-silenceable
Common Supervisory Contacts	1 amp @ 24VDC, resistive load, programable
Four wire detector power	24VDC @ 200mA Max. used for Special Application (non-supervised, for supervision use PSR-2040)
Environmental operating conditions	Ambient temperatures: 32 - 120 degree F (0 - 49 degrees C) Humidity: Max. 95% relative non-condensing

*Battery requirements calculated per individual system demands. (See battery selection data)
**240VAC 50/60 Hz 0.85amp maximum also available. Check installation wiring diagram (IWD).

Notification Appliance Circuits

Voltage	24 V Full wave rectified (FWR) with battery standby.
Current	Two amps per circuit three amps maximum combined
Maximum two conductor copper feed cable resistance may not exceed 1 ohm (see below 1.4 Volts Maximum Line Loss	
#10 AWG	Maximum of 500’ (feet)
#12 AWG	Maximum of 300’ (feet)
#14 AWG	Maximum of 200’ (feet)
Note: Notification Appliance Circuits current rating may be reduced depending on each systems current requirements. Reference the installation wiring diagram (IWD) for individual systems actual ratings. Reference DS-9066 for more information	

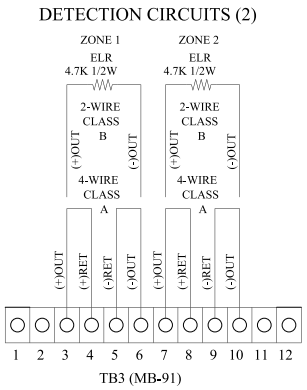
Note: Circuits do ***NOT*** generate a temporal pattern signal. Appliances that can generate a temporal pattern must be employed when a temporal pattern is required. Reference DS-9066 in this manual for compatible devices.

FS2000 Series Fire Detection
Deluge/Preaction Control Panel Information and Specifications
(continued)

INITIATING CIRCUITS

Class A (NFPA Style D)/Class B (NFPA Style A and B)

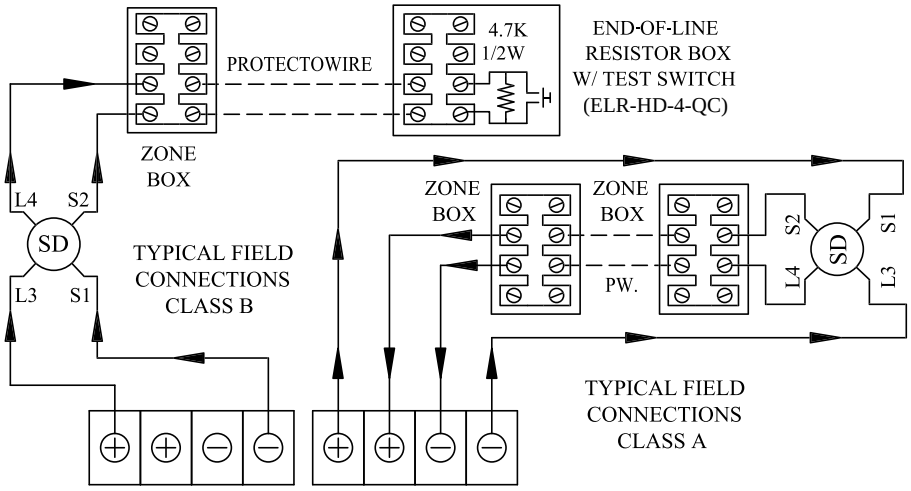
Voltage Standby	22VDC nominal, power limited
Current to ensure alarm	15mA (1K ohm loop resistance minimum)
Short circuit current	35mA
Supervision current	4.5mA



End-of-line resistor 4.7K ohm 1/2 watt (Class B only)

Maximum feed cable 100 ohms.

TYPICAL DETECTION CIRCUIT FIELD WIRING



INITIATING DEVICES

Use the following compatible devices approved by The Protectowire Company, Inc.:

- Up to 5,000 ft. of PROTECTOWIRE per circuit
- Any combination of normally open contact devices.

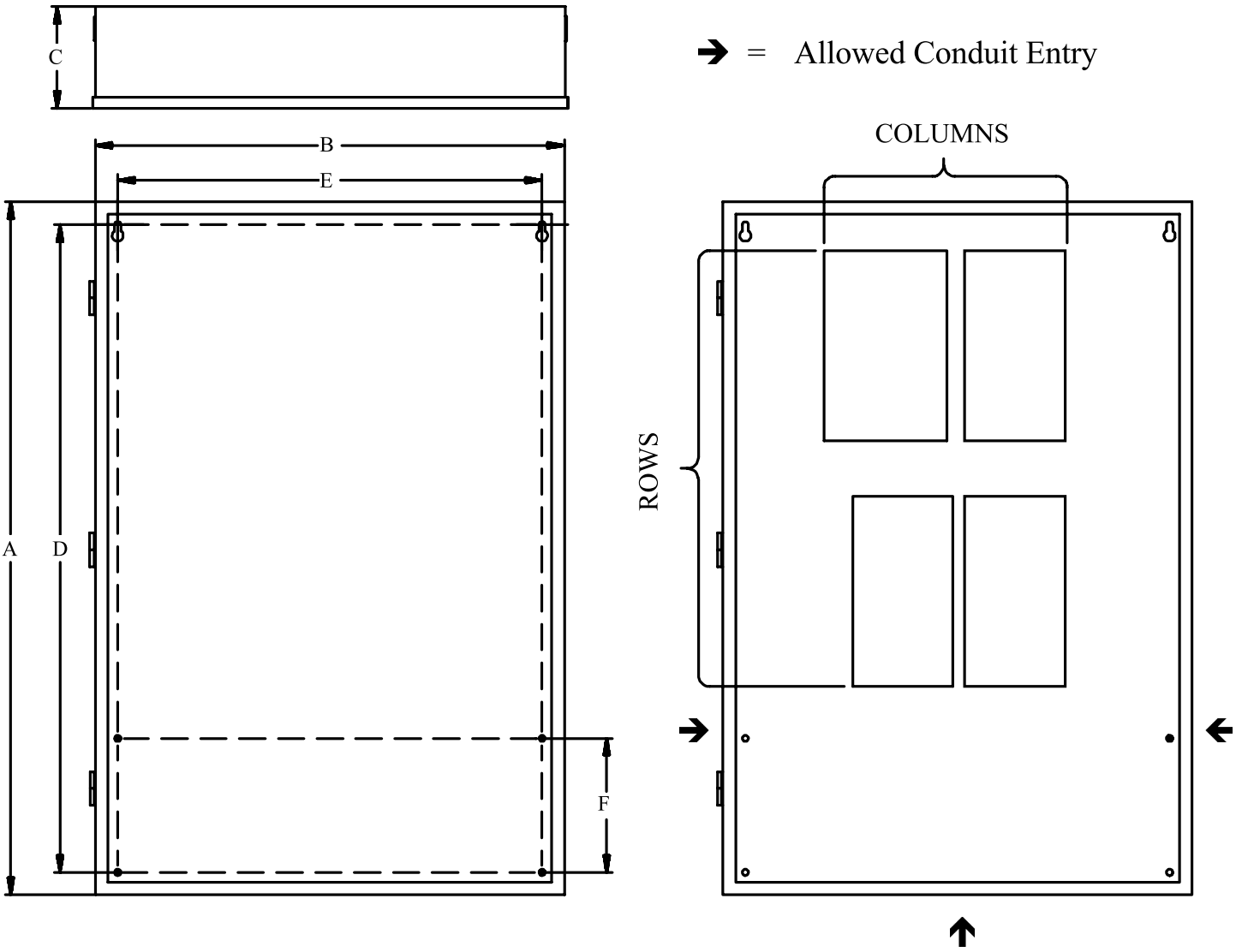
Note: Maximum feed cable resistance = 100 ohms Feed cable may consist of any combination of PROTECTOWIRE or copper wire.

- Up to (30) Two-Wire Smoke Detectors per circuit.
- Smoke Detectors NS-series #SLR-24V, #SIJ-24, #SLR-24H
- Detector Identifier - HD-3, Base Identifier - HB-3

Note: Smoke detectors shall not be employed on intrinsically safe detection circuits.

FS2000 Standard Enclosure Dimensions

(all dimensions in inches)



Enclosure Back Box Dimension Reference Table

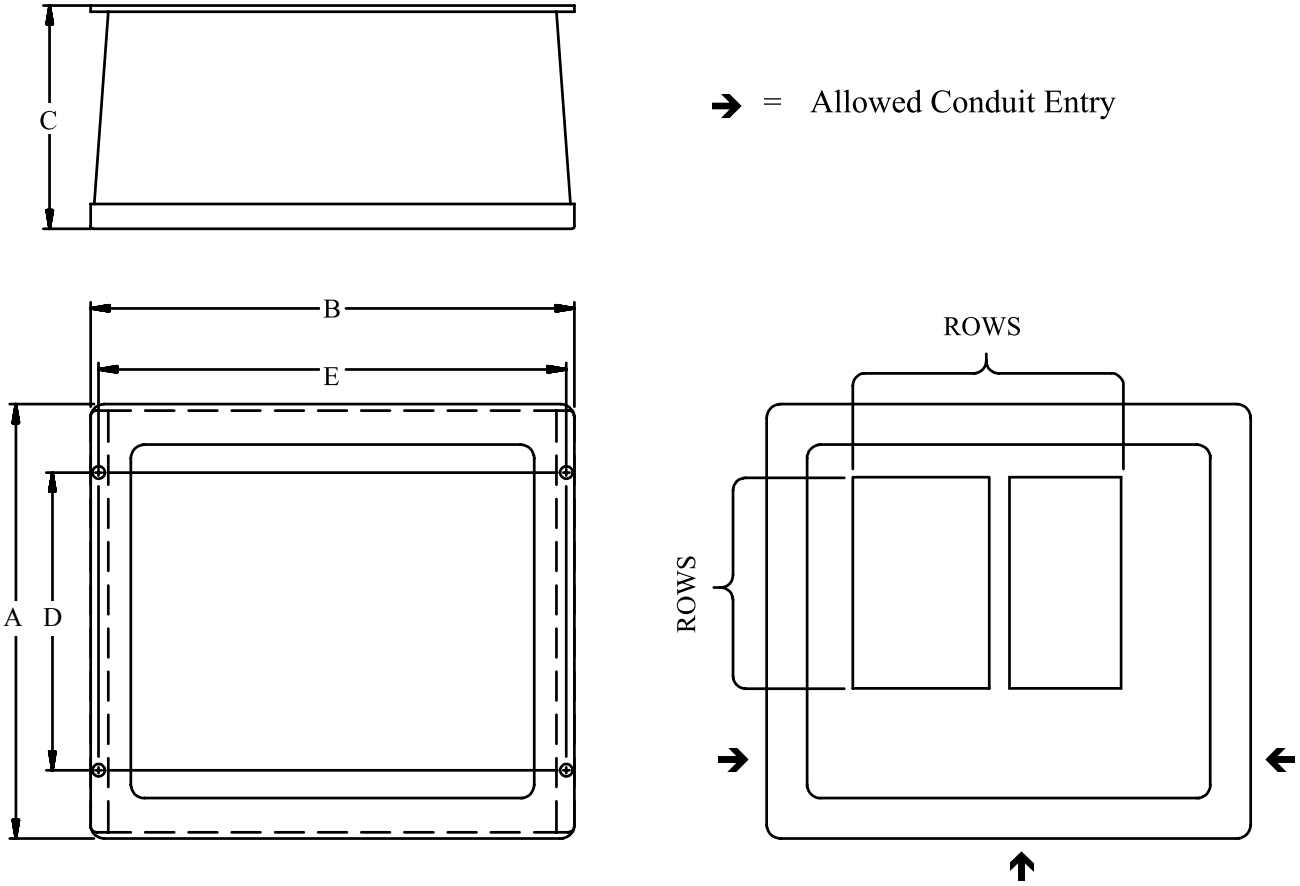
TYPE	A	B	C	D	E	F	ROWS	COLUMNS	SPACES
EN2	17”	21”	4.75”	15”	19”	6”	1	2	2
EN4	31”	21”	4.75”	29”	19”	6”	2	2	4
EN6	31”	26”	4.75”	29”	24”	N/A	2	3	6
EN9	42”	26”	4.75”	40”	24”	N/A	3	3	9
EN12	53”	26”	4.75”	51”	24”	20”	4	3	12
EN15	64”	26”	4.75”	62”	24”	29”	5	3	15

IMPORTANT: The above stated dimensions are for the enclosure back box only and do not account for the overall dimensions of the enclosure with the door installed. To account for the enclosure door and hinges add an additional 0.5” to the back box width (Dimension B) and 0.1” to the back box depth (Dimension C).

Caution: **Do not drill through the top of the enclosure for conduit entry. Metal filings and/or water entry from conduit system will damage system components and voids factory warranty. Use knockouts provided and seal all conduit openings.**

FS2000 LTi2X Enclosure Dimensions

(all dimensions in inches)



Enclosure Dimension Reference Table

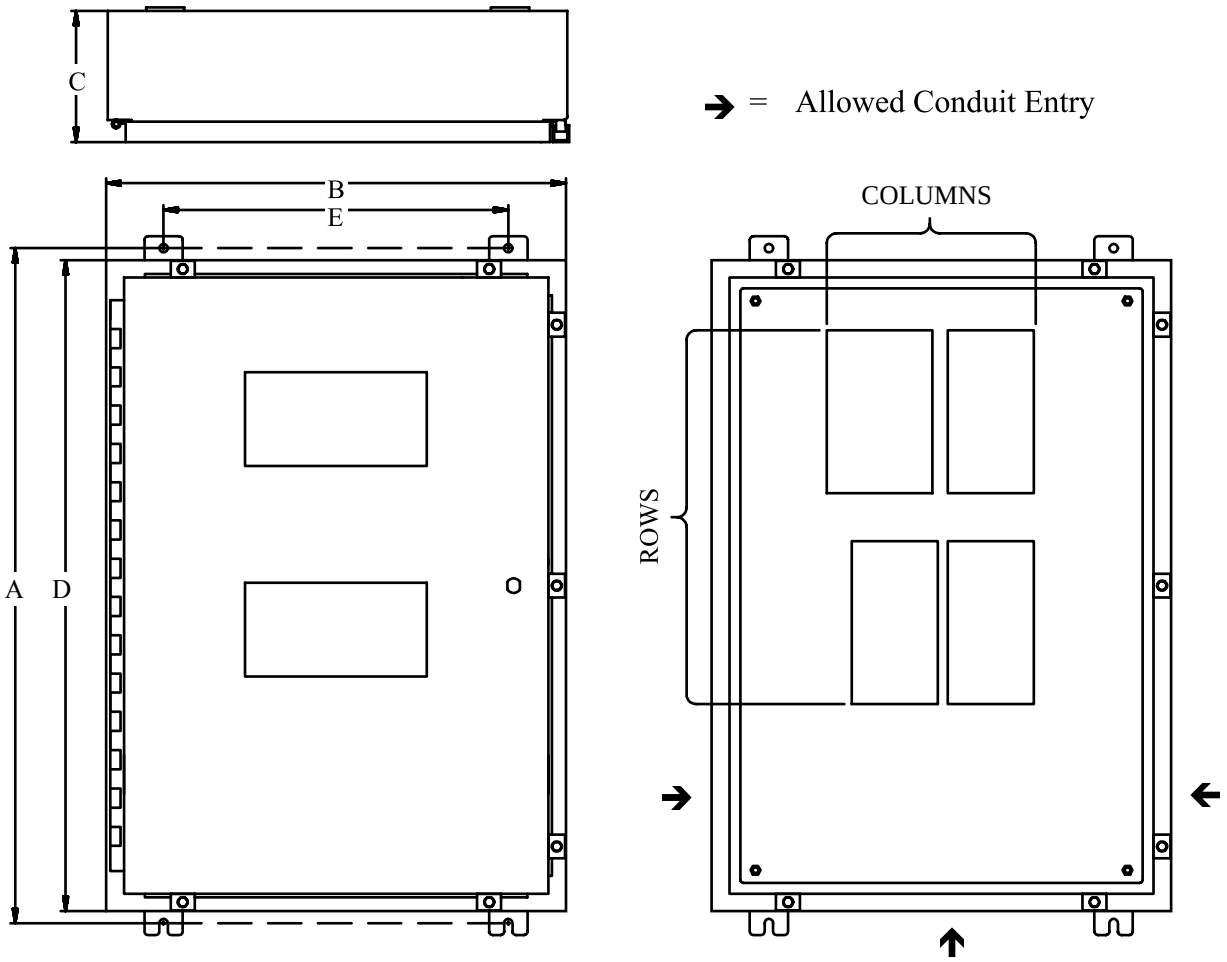
TYPE	A	B	C	D	E	ROWS	COLUMNS	SPACES
LTi2X	17.5”	19.5”	9”	12”	18.85”	2	1	2

Note: Enclosure shown represents the LTi2X only. For LTi4 - LTi9 dimensions reference the LTi4 -LTi9 dimensions page of this manual.

Caution: **Do not drill through the top of the enclosure for conduit entry. Metal filings and/or water entry from conduit system will damage system components and voids factory warranty. Use knockouts provided and seal all conduit openings.**

FS2000 LTi4 - LTi9 Enclosure Dimensions

(all dimensions in inches)



Enclosure Dimension Reference Table

TYPE	A	B	C	D	E	ROWS	COLUMNS	SPACES
LTi4	35.25”	24”	6.85”	34”	18”	2	2	4
LTi6	35.25”	29”	6.85”	34”	23”	2	3	6
LTi9	46.25”	29”	6.85”	45”	23”	3	3	9
Note: Enclosure shown represents the LTi4, 6 and 9 only. For LTi2X dimensions reference the LTi2X dimensions page of this manual.								

***Caution*: Do not drill through the top of the enclosure for conduit entry. Metal filings and/or water entry from conduit system will damage system components and voids factory warranty. Use knockouts when provided and seal all conduit openings.**

FS2000 Series Alarm Circuit Installation Guide
DS-9066A Issued 3-1-05
Alarm Notification Appliance Circuit Wire Size Estimator

To ensure that all alarm notification appliance circuits will be supplied with adequate power to operate, it is necessary to use the correct size feed cable for the distance and current requirement of each circuit. Follow the steps below to calculate the correct wire size for your application. The calculations are based on a maximum line loss (voltage drop) of 2 volts.

1. Calculate the required alarm device current.
   (Number of Devices) X (Device Current) = Total Alarm Device Current (amps).
2. Determine the wire run distance in feet from the panel to the last alarm device.
3. Find the load current (amps) on Table 3 that best matches the required alarm device current. If the device current is in between two values, use the higher value.
4. Find the wire run distance to the right of the device current value chosen in Step 3 which is greater than your requirement.
5. The gauge at the top of the distance column is what will be required to ensure a maximum line loss of less than 2 volts.

   EXAMPLE: If the total alarm device load is .680 amps; select .750 amps. If the measured distance is 400 ft.; select 517 ft. which is in the 14 AWG column.
   AWG = AMERICAN WIRE GAUGE

Table 1 - Compatible 24VDC Polarized Signal Devices

DEVICE	MFGR.	MODEL	AMPS
HORNS	AMESCO	H24W	0.035
		HW-24	0.035
	WHEELOCK	MIZ	0.043
	FEDERAL	450	0.25
MOTOR BELLS	AMESCO	MBA-6-24	0.012
		MBA-8-24	0.025
	WHEELOCK	MB	0.030
STROBE	AMESCO	SLW24W	0.120
		SAD24	0.250
	WHEELOCK	AHWP	0.100
		ASWP	0.113
	FEDERAL	LP3 SERIES	0.22
HORN/ STROBE	AMESCO	SHW24W	0.088
		SHP24	0.250
	WHEELOCK	NS4	0.361
STROBE/ BUZZER	FEDERAL	AV1ST	0.39
		AV1	0.98

For complete list of Notification Appliance Devices and their corresponding current draw **SEE APPENDIX A**

Table 2 - Copper Wire Resistance

GAUGE (AWG)	OHMS PER 1,000 FT. SINGLE CONDUCTOR
10	1.018
12	1.619
14	2.575
16	4.094
18	6.510

Table 3 - Alarm Indicating Circuit Wire Size for 24VDC Polarized Devices

TOTAL DEVICED LOAD (AMPS)	FEET OF 2 CONDUCTOR WIRE				
	18 AWG	16 AWG	14 AWG	12 AWG	10 AWG
0.060	2550	4050	6450	10250	16350
0.125	1200	1950	3150	4900	7850
0.250	600	950	1550	2450	3900
0.375	400	650	1000	1600	2600
0.500	300	450	750	1200	1950
0.625	200	350	600	950	1550
0.750	200	300	500	800	1300
1.000	150	200	350	600	950
1.250	100	150	300	450	750
1.500	100	150	250	400	650
1.750	50	100	200	350	550
2.000	50	100	200	300	450

Note: the maximum alarm indicating circuit resistance is calculated for a line loss of 2 volts divided by the maximum alarm device current.

FS2000 Series Fire Alarm Control Panel
Battery Size Calculation Sheet

Use this form to calculate the required battery size for your system. You must first determine the duration the panel will need to function on batteries in hours. The installation wiring diagram for your system includes a factory calculated battery size in the specification section. This calculation is based on a 24-hour backup period for non-releasing systems and a 90 hour backup period for systems with a solenoid releasing module. An alarm duration or period of time the system must operate in full alarm mode after the backup period has expired is assumed to be 15 minutes or 0.25 hours. This may be altered as necessary.

FORMULAS AND VARIABLES		
System Standby Current in amperes = (I1)	Standby Time in Hours = (H1)	Battery Size De-rate Divisor = (0.85)
System Alarm Current in amperes = (I2)	Alarm Time in Hours = (H2)	
System Battery Size required in ampere hours – [(I1 X H1) + (I2 X H2)] / 0.85 = Battery Size (AH) Note: Use next largest size		

Using the tables below, fill in the appropriate quantities for the options included in your system and multiple them with the corresponding current for each option and place the products in the product column. Add the product and sum in the total block

SYSTEM STANDBY CURRENT CALCULATIONS – Enter Quantities of Installed Options only					
Option	**Description**	**Quantity**		**Current**	**Product**
FS2000	Base System	1	X	0.045A	0.045
Zones	# of detection zones, multiples of 2 only, i.e. 2,4,6,8….		X	0.012A	
"C"	16 zone Alarm Scanner and Expanders, quantity between 1 and 3		X	0.011A	
"D"	Waterflow Zone Card, quantity D = 1, D2 = 2….		X	0.025A	
"E"	Switch Supervisory Zone Card, quantities E=1, E2=2….		X	0.025A	
"F"	Solenoid Release Card, RS-1 quantities F=1, F2=2 ….		X	0.015A	
"U"	Alarm Expander Card, quantities U=1, U2=2….		X	0.005A	
"V"	Zone Voting Module, quantities V=1, V2=2….		X	0.006A	
"X"	Dual Temperature Zone Card, quantities X=1, X2=2…..		X	0.030A	
"Y"	Power Conditioning Module (Option Y) – See Note A		X		
Other	4-wire Smoke Detectors, UV/IR Detectors- See Note A		X		
Note A: Quantity and Current determined by # of devices installed and current rating of each devices				**Total (I1)**	

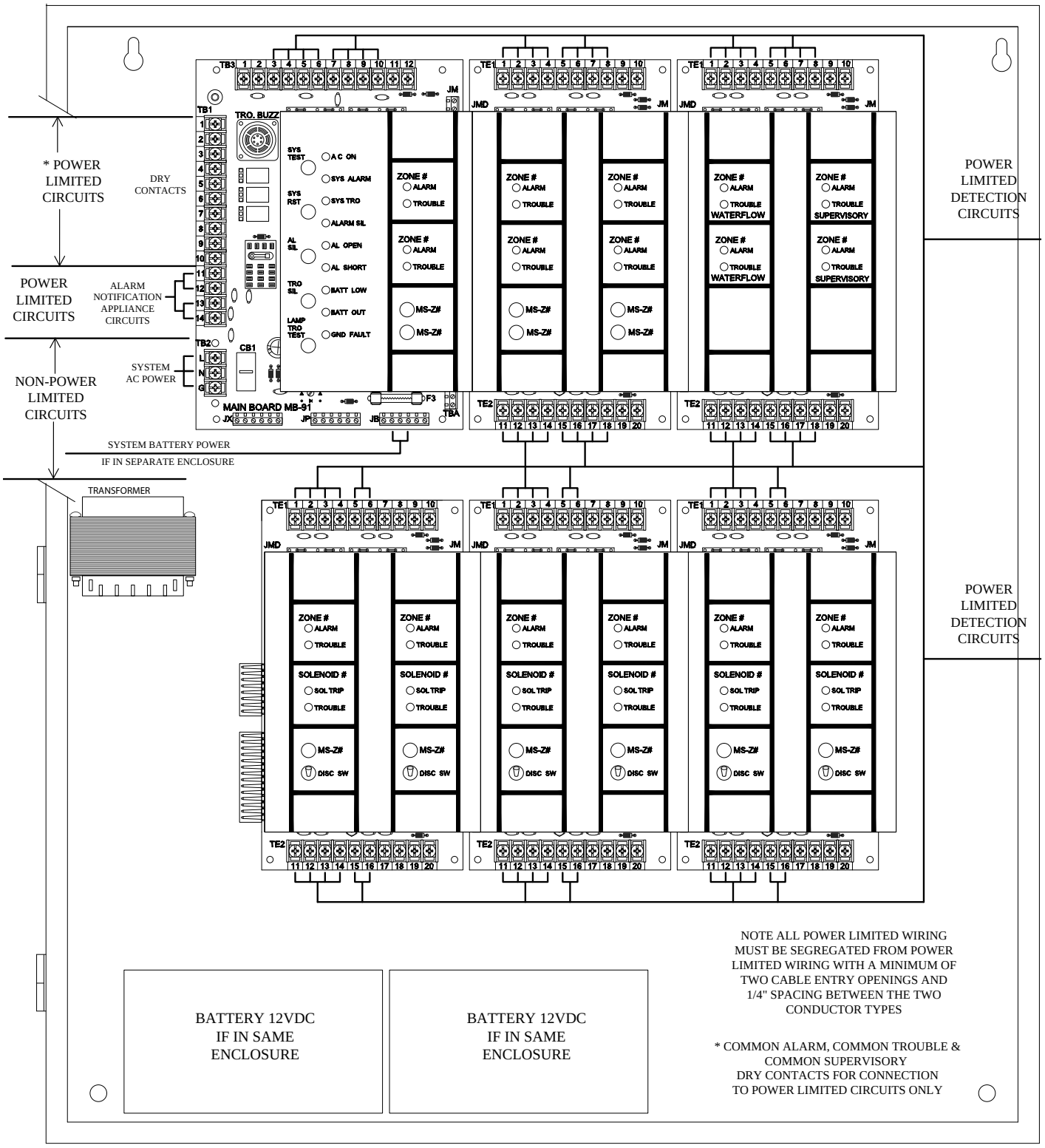
SYSTEM ALARM CURRENT CALCULATIONS- Enter Quantities of Installed Devices only				
Device Description	Quantity		Current	Product
PDM-1000-2 Digitial Meter		X	0.100A	
Auxiliary Relay Module RB-98 (Option "RR")		X	0.104A	
AM-91-1 Class A Alarm N.A.C. Adapter		X	0.004A	
Solenoid Valve (See Complete list / Current draw in Appendix A)		X		
Auxiliary Relays SPDT (Option "L")		X	0.015A	
Auxiliary Relays DPDT (Option "LL')		X	0.035A	
MB Bells (Wheelock)		X	0.030A	
SZ5424 Series Horn/Strobe (Amesco)		X	0.250A	
VALS-24 Strobe Light (Federal)		X	0.080A	
450 Vibratone Horn (Federal)		X	0.025A	
SFH Speaker / Strobe Combination (Amesco)		X	0.114A	
MTWP Series Horn / Strobe (Wheelock)		X	0.126A	
See Complete list and current draw in Appendix A				
			Subtotal	
System Standby Current (Total I1 from Calculations above)	1	X		
			Total (I2)	

SYSTEM BATTERY SIZE CALCULATIONS	
[(I1 x H1) + (I2 x H2)] / 0.85=Minimum AH	
[(x) + (x)] / 0.85= AH	
H1 = 24 Hours Local	H2= 0.25 Hrs Required per FM
H2 = 60 Hours Off Premise	Note: Use next largest available battery size
H1 = 90 Hours Required by FM (Releasing Systems)	
From the chart to the right, select the available battery size for your panel. Other sizes are available upon request	

AVAILABLE BATTERIES		
Catalog #	**Rating (AH)**	**Battery Cabinet**
PS1270	7.0AH	Not required
PS6100	12.0 AH	Not required
PS12180	18.0 AH	Not required
PS12335	35.0 AH	E-.5 (red) E-.5B beige
PS12400	40.0 AH	E-.5 (red) E-.5B beige
PS12550	55.0 AH	E-.5 (red) E-.5B beige
* Required for EN2 enclosure – Not required for larger sizes		

FS2000 Series Fire Alarm Control Panel
Typical Panel Wire Routing Detail
DS-9079B

When bringing field wires to and from the control panel you *must* maintain segregation between Power Limited and Non-Power Limited wiring. Use the illustration below as a guideline for routing wire within the system enclosure. Also reference the field wiring sections of this manual to determine which field connections are Power Limited and which are Non-Power Limited.


* POWER LIMITED CIRCUITS
DRY CONTACTS
POWER LIMITED CIRCUITS
ALARM NOTIFICATION APPLIANCE CIRCUITS
NON-POWER LIMITED CIRCUITS
SYSTEM AC POWER
SYSTEM BATTERY POWER
IF IN SEPARATE ENCLOSURE
TRANSFORMER
POWER LIMITED DETECTION CIRCUITS
POWER LIMITED DETECTION CIRCUITS
MAIN BOARD MB-91
TRO. BUZZ
WATERFLOW
SUPERVISORY
BATTERY 12VDC IF IN SAME ENCLOSURE
BATTERY 12VDC IF IN SAME ENCLOSURE
NOTE ALL POWER LIMITED WIRING MUST BE SEGREGATED FROM POWER LIMITED WIRING WITH A MINIMUM OF TWO CABLE ENTRY OPENINGS AND 1/4" SPACING BETWEEN THE TWO CONDUCTOR TYPES
* COMMON ALARM, COMMON TROUBLE & COMMON SUPERVISORY DRY CONTACTS FOR CONNECTION TO POWER LIMITED CIRCUITS ONLY

FS2000 Series Fire Detection - Preaction/Deluge Control Panel Operation Installation Test and Maintenance

Installation and System Power-Up.

1. Carefully unpack the system and inspect for any visible damage from shipping.

2. Mount the system in a clean, easily accessible, stable area with four (4) 1/4" screws. The system enclosure should be mounted to allow clear visibility of the systems control indicators and easy access to the systems control switches.

3. Wire the system according to this manual and the Installation Wiring Diagram (IWD). Wiring should be in accordance with applicable National and/or Local, Electrical and Fire Alarm codes. **Warning:** DO NOT implement conduit entry through the top of the electrical enclosure. Condensation in the conduit system could enter the enclosure and damage system components. Where possible, use conduit entries provided. When making additional conduit entries, take measures to ensure metal drill filings and debris does not enter the components of the system. All conduit entries should be sealed to avoid water entering from the conduit system into the system enclosure. *Failure to comply with the above will void the factory warranty.*

   Special Note: All supervised circuits are conditioned at the factory with an end-of-line resistor (ELR-4.7K) or dummy load resistor across the circuit field terminals. End-of-line resistors & dummy load resistors should be removed when field wiring is connected to the circuit terminations. Class B supervised circuits require the end-of-line resistor (ELR-4.7K) be connected at or after the last device on the circuit. Class A supervised circuits do not require an end-of-line resistor. Solenoid Release Circuits are conditioned with a dummy resistor across the field connections. The resistor should be removed when field wiring is connected at the field terminals.

4. **For systems with solenoid release circuits only**. Ignore this step if the system does not contain solenoid releasing circuits. Slide *ALL* solenoid disconnect switches to the down (disconnect) position to prevent accidental activation of solenoids.

5. Connect applicable power according to the systems rating as identified on the Installation Wiring Diagram (IWD) and on the model ID tag mounted on the inside of the enclosure door.
   a) Load connection, MOD-1 TB2 terminal "L"
   b) Neutral connection MOD-1 TB2 terminal "N"
   c) Ground connection MOD-1 TB2 terminal "G"

6. **For systems with solenoid release circuits only**, ignore this step if your system has no solenoid releasing circuits. System will be in a supervisory alarm condition when powered due to the disconnection of the solenoids from Step 4. Silence the system by pressing the "TRO./SUP. SIL." button.

7. Disconnect dummy battery load resistor from the system battery connectors and connect standby batteries. If batteries are not pre-charged, they will take up to 48 hours to charge to full capacity.

8. Verify that no trouble indicators are illuminated except under the following conditions. The system has solenoid releasing circuits, the disconnect switches are in the down (disconnect) position and the "SOL. OPEN" indicator is illuminated. The batteries connected to the system were not pre-charged and the "BATT. LOW" indicator is illuminated. If any other trouble lights are illuminated, determine the problem with those circuits using the troubleshooting guide in this manual and repair them before continuing.

9. **For systems with solenoid release circuits only**, ignore this step if your system has no solenoid releasing circuits. Slide all solenoid disconnect switches to the up (connected) position. The "AC ON" indicator should be the only system indicator illuminated.

10. Test the System per the "Test and Maintenance" Procedure in this manual.

FS2000 Series Fire Detection - Preaction/Deluge Control Panel Operation Installation, Test and Maintenance

Testing and Maintenance

Quarterly testing is advised to help ensure system controls are functioning properly. Testing should be performed by competent personnel having jurisdiction over the protective signaling system. The following instructions should be observed in conjunction with the *System Operational Outline* contained in this manual when testing this equipment.

1. Notify the applicable local fire department and/or alarm receiving station.

2. Inform all personnel in the facility that testing is in progress–start of testing to finish.

3. Disconnect any and all auxiliary alarm devices. (Solenoids, system shutdowns, etc.)

4. *ALARM TEST*–For systems equipped with a "SYS TEST" feature, Press "SYS. TEST" button located on the control panel for approximately three seconds. The "SYSTEM ALARM" and all zone "ALARM" indicating lamps will illuminate indicating an alarm condition for each zone. All connected alarm devices will activate. (Alarm notification appliances, relays, etc.) Note: **This is a "special order" feature only**.

   NO TEST SYSTEMS–Systems that are configured for solenoid release ***DO NOT*** have a "SYS. TEST" button installed to avoid accidental activation of solenoid valves. Testing of such systems may be accomplished by placing a jumper across each detection/initiating circuits field terminals ***ONLY AFTER*** all solenoid disconnect switches on each release module have been placed in the down (disconnect) position.

5. Press the "SYS. RST." button located on the control panel to return to standby condition.

6. *SUPERVISION TEST*–Open supervised circuits (Detection, Switch Supervisory, Alarm Notification Appliance Circuits, Solenoid, Waterflow Detection, etc.) by removing one wire lead from the field terminal for each individual circuit one at a time. Replace each wire before moving on to the next circuit.

7. *LAMP TEST*–Press and hold the "LAMP/TRO. TEST" button located on the control panel. The "SYS. TROUBLE / SUP." and "AL. SIL." indicators will flash. All other indicators will be on steady and the trouble buzzer will pulse. Release the button to return to standby condition.

Testing Note:

The following LED indications will occur in addition to the system ground fault trouble when the respective circuit is connected to earth ground.

a) The Alarm Expander card (AE-91) circuits "OPEN" & "SHORT" indicators will illuminate if the positive leg of the circuit is connected to earth ground.
b) The Alarm notification appliance circuit "OPEN" indicator will illuminate if the positive leg of the circuit is connected to earth ground.
c) The Solenoid Releasing board (RS-1) circuits "TROUBLE" indicator will illuminate if the positive leg of the circuit is connected to earth ground.

These indications are an adverse effect caused by ground faults but can prove useful in identifying the location of a ground fault when they occur.

WARNING

FATAL ELECTRICAL SHOCK AND EQUIPMENT DAMAGE MAY RESULT FROM FAILURE TO REMOVE AND LOCK OUT ALL POWER PRIOR TO SERVICING SYSTEM

FS2000 Series Fire Detection - Preaction/Deluge Control Panel Operation Installation Test and Maintenance

Operational Outline:

1. **Normal Standby Condition**
   a) "AC ON" Indicator (Green) illuminated.

2. **Power Supervision**
   AC power source failure:
   a) "AC ON" Indicator (Green) OFF.
   b) System trouble buzzer ON (Pulsing) - Press "SUP./TRO. SIL." button to silence.
   c) "SYS. TRO." Indicator (Yellow) Flashing.
   d) Restore AC power to resume standby condition.
   DC power source failure:
   a) "SYSTEM. TROUBLE / SUP." Indicator (Yellow) Flashing.
   b) "BATTERY OUT" Indicator (Yellow) ON.
   c) System trouble buzzer ON (Pulsing) - Press "SUP. / TRO. SIL." button to silence.
   d) Restore DC power to resume standby condition.

3. **Alarm Detection Circuits**
   Short in detection loop/device or fault = Alarm Condition:
   a) "SYSTEM ALARM" Indicator (RED) ON.
   b) "ZONE ALARM" Indicator (RED) ON.
   c) All alarm notification appliance circuits activated. Press "AL. SIL." button to silence, "AL. SIL." Indicator (Yellow) Flashing.
   d) Restore detection circuit or initiating device. Press "SYS. RST." button to return to standby condition.
   Open in detection loop - Zone Trouble/System Trouble:
   a) "SYSTEM TROUBLE / SUP." Indicator (Yellow) Flashing.
   b) "ZONE TROUBLE" Indicator (Yellow) ON.
   c) System trouble buzzer ON (Pulsing) - Press "SUP./TRO. SIL." button to silence.
   d) Clear detection circuit to return to standby condition.

4. **Notification Appliance Circuits**
   Short in notification appliance circuit loop - Al. Short:
   a) "SYSTEM TROUBLE / SUP" Indicator (Yellow) Flashing.
   b) "ALARM SHORT" Indicator (Yellow) ON.
   c) System trouble buzzer ON (Pulsing) - Press "SUP. / TRO. SIL." button to silence.
   d) Clear (repair) short to circuit to return to standby condition.
   Open in notification Appliance circuit loop - Al. Open:
   a) "SYSTEM TROUBLE / SUP." Indicator (Yellow) Flashing.
   b) "ALARM OPEN" Indicator (Yellow) ON.
   c) System trouble buzzer ON (Pulsing) - Press "SUP. / TRO. SIL." button to silence.
   d) Clear (repair) open to circuit to return to standby condition.

5. **Switch Supervisory Zone**
   Short in switch supervisory circuit - Supervisory Alarm/System Trouble:
   a) "SYSTEM TROUBLE / SUP." Indicator (Yellow) steady.
   b) "ZONE ALARM" Indicator (Yellow) ON.
   c) System trouble buzzer ON (Steady) - Press "SUP. / TRO. SIL." button to silence. System is now ready for subsequent supervisory alarm i.e., next supervisory alarm condition will reinstate system supervisory alarm condition.
   d) Press "SUP. / TRO. SIL." button to silence.
   e) Restore supervisory circuit or initiating device. Press "SYS. RST." button to return to standby condition.
   Open in switch supervisory circuit - Supervisory Trouble/System Trouble:
   a) "SYSTEM TROUBLE / SUP." Indicator (Yellow) Flashing.
   b) "ZONE TROUBLE" Indicator (Yellow) ON.
   c) System trouble buzzer ON (Pulsing) - Press "SUP. / TRO. SIL." button to silence.
   d) Repair open to return to standby condition.

FS2000 Series Fire Detection - Preaction/Deluge Control Panel Operation Installation Test and Maintenance

Operational Outline Continued:

6. **Ground Fault Detection Circuit** (Not available with Option "H")
   When undesirable current flows to ground from the system DC power supply, either positive or negative:
   a) "SYSTEM TROUBLE / SUP" Indicator (Yellow) Flashing.
   b) "GND. FAULT" Indicator (Yellow) ON.
   c) System trouble buzzer ON (Pulsing) - Press "SUP / TRO. SIL." button to silence.
   d) Repair Ground Fault and allow 5 seconds for system to restore to standby condition.

7. **Waterflow Detection Circuit**
   Open in waterflow detection circuit - Zone Trouble/System Trouble:
   a) "SYSTEM TROUBLE / SUP" Indicator (Yellow) Flashing.
   b) "ZONE TROUBLE" Indicator (Yellow) ON.
   c) System trouble buzzer ON (Pulsing)
   d) Press "TRO. SILENCE" button to silence.
   e) Repair Open to return to standby condition.
   Short in waterflow detection circuit - Waterflow Alarm/System Alarm:
   a) "SYS. AL." Indicator (Red) ON.
   b) "ZONE AL." Indicator (Red) ON.
   c) All alarm notification appliance circuits activated. - Press "AL. SIL." button to silence, "AL. SIL." indicator (Yellow) flashing.
   d) Restore waterflow circuit or initiating device. Press "SYS. RST." button to return to standby condition.

8. **Solenoid Release/Supervision Circuit**
   Short in releasing circuit - Solenoid Short:
   a) "SYSTEM TROUBLE / SUP" Indicator (Yellow) Flashing.
   b) "SOLENOID SHORT" Indicator (Yellow) ON.
   c) System trouble buzzer ON (Pulsing)
   d) Press "SUP. / TRO. SIL." button to silence.
   e) Repair short to return to standby condition.
   Open in releasing circuit - Solenoid Open:
   a) "SYSTEM TROUBLE / SUP" Indicator (Yellow) Flashing.
   b) "SOLENOID OPEN / DISC." Indicator (Yellow) ON.
   c) System trouble buzzer ON (Pulsing).
   d) Press "SUP. / TRO. SIL." button to silence.
   e) Repair open to return to standby condition.
   Trip (activation) of releasing circuit - Determined by zone programming:
   a) 24 VDC or 24FWR supplied at solenoid terminals. (factory set)

9. **Expanded Alarm Notification Appliance Circuit**
   Short in alarm notification appliance circuit:
   a) ""SYSTEM TROUBLE / SUP"." Indicator (Yellow) Flashing.
   b) Alarm Expander "AL. TROUBLE SHORT" indicator (Yellow) ON.
   c) System trouble buzzer ON (Pulsing) - Press "SUP. / TRO. SIL." button to silence.
   d) Repair short to return to standby condition.
   Open in Alarm notification appliance circuit:
   a) ""SYSTEM TROUBLE / SUP"" Indicator (Yellow) Flashing.
   b) Alarm Expander "AL. TROUBLE OPEN" indicator (Yellow) ON.
   c) System trouble buzzer ON (Pulsing) - Press "SUP / TRO. SIL.' button to silence.
   d) Repair Open to return to standby condition.
   Trip (activation) of Expanded Alarm Notification Appliance Circuit:
   a) Alarm Expander "ALARM" Indicator (Red) ON.
   b) Alarm notification appliances operating - audible/visual devices
   c) Press "Alarm Expander Silence" button to silence.
   d) Clear Alarm and press "SYS. RST." to return to standby condition - **Circuit must be silenced prior to reset**.

FS2000 Series Fire Detection - Preaction/Deluge Control Panel Operation Installation Test and Maintenance

	Basic Troubleshooting Guide for The FS2000 Series Fire Alarm Control Panel			
	Indicator Status	**Fault Condition**	**Course of Action**	**Alternate Action**
Primary	"A.C. ON" Indicator OUT "SYS. TROUBLE / SUP." Indicator flashing Trouble Buzzer Pulsating	AC Power source failure	Check AC power source Connections and voltage Reset Circuit breaker CB1 Located on the Main Board.	Check AC voltage across terminals JX 3 and 4 of the Main Board. If approximately 30 VAC replace control card (CC-91A). If not, check the transformer and connections
Standby Power	"A.C. ON" Indicator ON "SYS. TROUBLE / SUP" Indicator flashing "BATTERY OUT' Indicator ON Trouble Buzzer Pulsating	Backup Power source failure Batteries disconnected or overcharged	Check the battery connections. Check battery fuse F3 On Main Board	Check battery voltage with charger connected. Voltage should be between 26-28 volts. Replace batteries if needed.
	"A.C. ON" Indicator ON "SYS. TROUBLE / SUP." Indicator flashing "BATTERY LOW" Indicator ON Trouble Buzzer Pulsating	Backup Power source failure Batteries undercharged or drained below acceptable voltage level of approximately 20.4 VDC	Check the battery voltage and be sure to allow at least 48 hours for charging of new or drained battery sets. If batteries do not charge, replace them.	If battery voltage is above acceptable voltage level, replace control card (CC-91A)
Alarm Notification Appliance Circuits	"A.C. ON" Indicator ON "SYS. TROUBLE / SUP." Indicator flashing "AL SHORT" Indicator ON Trouble Buzzer Pulsating	Alarm Notification Appliance Circuit fault. A short exists in the Alarm Notification Circuit field wiring.	Remove the Alarm Notification Appliance Circuit field wiring from the field terminals and replace with an end-of-line resistor 4.7K ohm ½ W. (ELR-4.7K). If the condition clears, fault is located in the field wiring. Find and replace short.	If condition does not clear, replace the control card (CC-91A)
	"A.C. ON" Indicator ON "SYS. TROUBLE / SUP." Indicator flashing "AL OPEN" Indicator ON Trouble Buzzer Pulsating	Alarm Notification Appliance Circuit fault. A open exists in the Alarm Notification Circuit field wiring	Remove the Alarm Notification Appliance Circuit field wiring from the field terminals and replace with an end-of-line resistor 4.7K ohm ½ W. (ELR-4.7K). If the condition clears, fault is located in the field wiring. Find and replace open.	If condition does not clear, replace the control card (CC-91A)
Ground Fault	"A.C. ON" Indicator ON "SYS. TROUBLE / SUP." Indicator flashing "GND FAULT" Indicator ON Trouble Buzzer Pulsating	A ground fault exists. Either a Positive or Negative connection exists to earth ground in the system or its field wiring. * Impedance < .1 ohm	All field wiring must be tagged and removed from the field terminals until condition clears or all wiring has been isolated. If condition clears after removing a field wire, fault(s) exists in that wire. Repair fault and reconnect all field wiring.	If after all field wiring is isolated from the panel the condition still exists, consult factory.
Detection Circuits	"A.C. ON" Indicator ON "SYS.TROUBLE / SUP." Indicator flashing "ZONE TROUBLE" Indicator ON Trouble Buzzer Pulsating (*includes detection, waterflow and switch supervisory zones*)	Open in zone circuit field wiring.	**Class B** – Remove the Zone Circuit field wiring from the field terminals and replace with an end-of-line resistor 4.7K ohm ½ W. (ELR-4.7K) across the (+) and (-) out terminals. **Class A** –place jumpers across the field terminals in a Class A configuration. If the condition clears fault is in the field wiring. Find and repair open.	If the circuit does not clear when conditioned as stated previously, replace the Zone Card (ZC-91A). If the problem still persists, consult the factory.

Continued on next page

FS2000 Series Fire Detection - Preaction/Deluge Control Panel Operation Installation, Test and Maintenance

Continued from previous page

	Basic Troubleshooting Guide for The FS2000 Series Fire Alarm Control Panel			
	Indicator Status	**Fault Condition**	**Course of Action**	**Alternate Action**
Detection Circuits	"A.C. ON" Indicator OUT "SYS. ALARM" Indicator ON Zone "ALARM" Indicator ON	Short in zone circuit field wiring or initiating device in alarm i.e., Smoke detector, Linear heat detector, etc.	**Class B** – Remove the Zone Circuit field wiring from the field terminals and replace with an end-of-line resistor (ELR-4.7K) across the (+) and (-) out terminals. **Class A-**Place jumpers across the field terminals in a Class A configuration. Depress the "SYS. RST" button. If the condition clears, fault is in the field wiring. Find and repair short or initiating device.	If the circuit does not clear when conditioned as stated previously, replace the Zone Card (ZC-91A). If the problem still persists, consult the factory
Solenoid Release	"A.C. ON" Indicator ON "SYS. TROUBLE / SUP" Indicator flashing "SOLENOID "TROUBLE / DISC." Indicator ON Trouble Buzzer Pulsating	Solenoid Release Circuit fault. An open exists in the solenoid release circuit field wiring.	Check Solenoid Release Circuit fuse F1 on Release Card. Check that "SOL. DISC. SWITCH" is in the up (connect) position. Check Solenoid Release Circuit Field wiring for continuity.	After removing field wiring, simulate a solenoid connection by placing a 1K, 1W resistor across the field wiring terminals. If condition does not clear consult the factory.
	"A.C. ON" Indicator ON "SYS. TROUBLE / SUP." Indicator flashing "SOLENOID "TROUBLE / DISC." Indicator ON Trouble Buzzer Pulsating	Solenoid Release Circuit fault. An short exists in the solenoid release circuit field wiring.	Check the solenoid coil for a short by disconnecting it and checking that its resistance is within tolerance. Check field wiring for a short circuit.	After removing field wiring, simulate a solenoid connection by placing a 1K, 1W resistor across the field wiring terminals. If condition does not clear consult the factory.
Alarm Notification Appliance Circuits	"A.C. ON" Indicator ON "SYS. TROUBLE / SUP." Indicator flashing Alarm Expander Card - "AL. TROUBLE OPEN" Indicator ON Trouble Buzzer Pulsating	Alarm Expander Notification Appliance Circuit fault. An open exists in the Alarm Expander Circuit field wiring.	Check fuse F7 located on the Alarm Expander Card. Check the field wiring for continuity. Replace fuse or repair open in field wiring as required.	**Class B** – Remove the field terminals and replace with an end-of-line resistor (ELR-4.7K) across the (+) and (-) out terminals. **Class A** – Place jumpers across the field terminals in a Class A configuration. If the condition clears, fault is in the field wiring. Find and repair open.
	"A.C. ON" Indicator ON "SYS. TROUBLE / SUP." Indicator flashing Alarm Exp ander Card - "AL. TROUBLE SHORT" Indicator ON Trouble Buzzer Pulsating	Alarm Expander Notification Appliance Circuit fault. A short exists in the Alarm Expander Circuit field wiring.	**Class B** – Remove the field terminals and replace with an end-of-line resistor (ELR-4.7K) across the (+) and (-) out terminals. **Class A** – Place jumpers across the field terminals in a Class A configuration. If the condition clears, fault is in the field wiring. Find and repair short.	Check for faulty Alarm Notification Appliance device. If condition does not clear with circuit conditioned at the field terminals as described previously, replace the Alarm Expander Card (AE-91).

FS2000 Series Fire Detection -
Preaction/Deluge Control Panel Part Replacement Instructions
DS-9038 Rev. B

Initial Steps

1. Notify the applicable local fire department and/or alarm receiving station that the system is being serviced.
2. Inform all personnel in the facility that testing is in progress, from the start of servicing to its completion.
3. Reference the systems Installation Wiring Diagram (IWD) for specific connection and component information.
4. Disconnect any and all auxiliary alarm devices. (Solenoids, system shutdowns, etc.)
5. Disconnect *ALL* system power and lock out (both Primary AC power and Battery Backup power) and verify the system is shut down. Failure to disconnect all power can result in personal injury and/or damage to equipment.

Circuit Card Replacement - **(Includes Control Card CC-91A/I/NT, Zone Card ZC-91A/I/M/W, Switch Supervisory Card SC-91A/I/NL, Alarm Expander Card AE-91/N and Solenoid Releasing/ Initiating Card RS-1)**

1. Follow the “Initial Steps” above.
2. Detach the Display Panel (DP-1067, DP-1079 or DP-1151) covering the card to be replaced by removing the two mounting screws and set aside.
3. Note the position of the card to be removed. Replacement should be installed in the same position. Grip the card by the ejector handles at each end of the card and pull gently from the expansion slot edge terminal. Pull the card out straight and evenly. Do not pull out one end of the card at a time as this may damage the connector.
4. Line up the replacement card with the expansion slot edge terminal noting the polarity of the card. Pin 1 of the edge terminal will be at the top. Gently slide the card into the expansion slot. Push the card in straight and evenly. Do not insert one end of the card at a time as this may damage the connector.
5. With the card inserted, replace the Display Panel being sure to properly tighten the mounting screws.
6. See “Final Steps.”

Circuit Board Replacement - **(Includes Main Board MB-91A/M and Expander Board EB-91A/M)**

Follow the “Initial Steps” above.

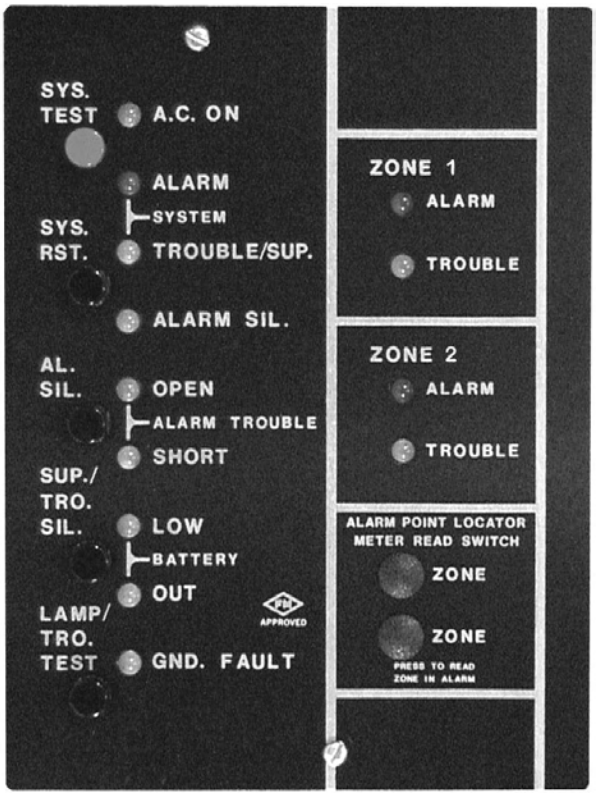
1. Remove mounting screws of board to be replaced and adjacent boards if necessary. Some boards, depending on position, *cannot* be removed without dismounting adjacent boards.
2. Lift the board off its mounting standoffs being sure to disconnect it from any interconnection to an adjacent board.
3. Disconnect and tag each wire terminated on the board, including field wiring, factory wiring and harnesses.
4. Remove the board from the system and substitute with its replacement. Re-terminate all wires, referencing each wires tag for terminal designations. Reconnect all wiring harnesses to their proper interface terminals.
5. Remount all circuit boards to their proper mounting standoffs being sure to reconnect all board-to-board interconnections. Make sure no wires are pinched between the board and its mounting standoffs before tightening the mounting screws.
6. See “Final Steps.”

Final Steps

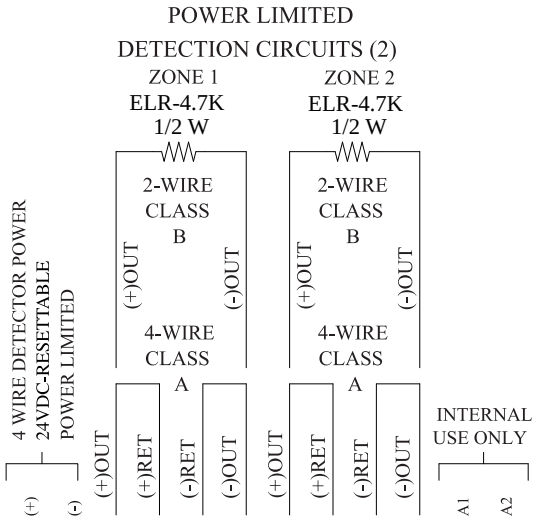
1. Visually check that all boards are mounted properly and all terminations are correct.
2. Restore power to the control panel, both primary AC power and Battery Backup.
3. Test the system for proper operation and reference the operational outline in the test and maintenance pages of the manual.
4. Reconnect any and all auxiliary alarm devices. (Solenoids, system shutdowns, etc.)

Main Board - MB-91A

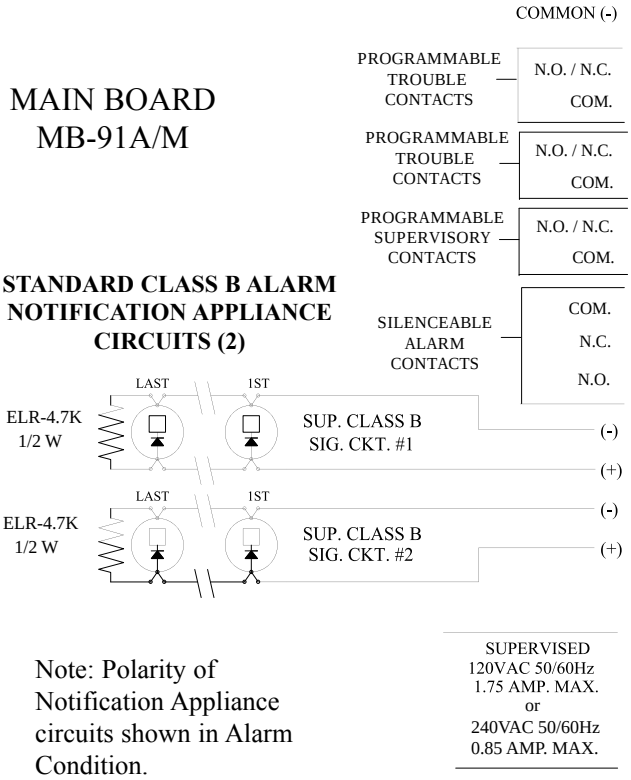
Sys. Test feature is available on special orders only and is not provided on systems with solenoid releasing.



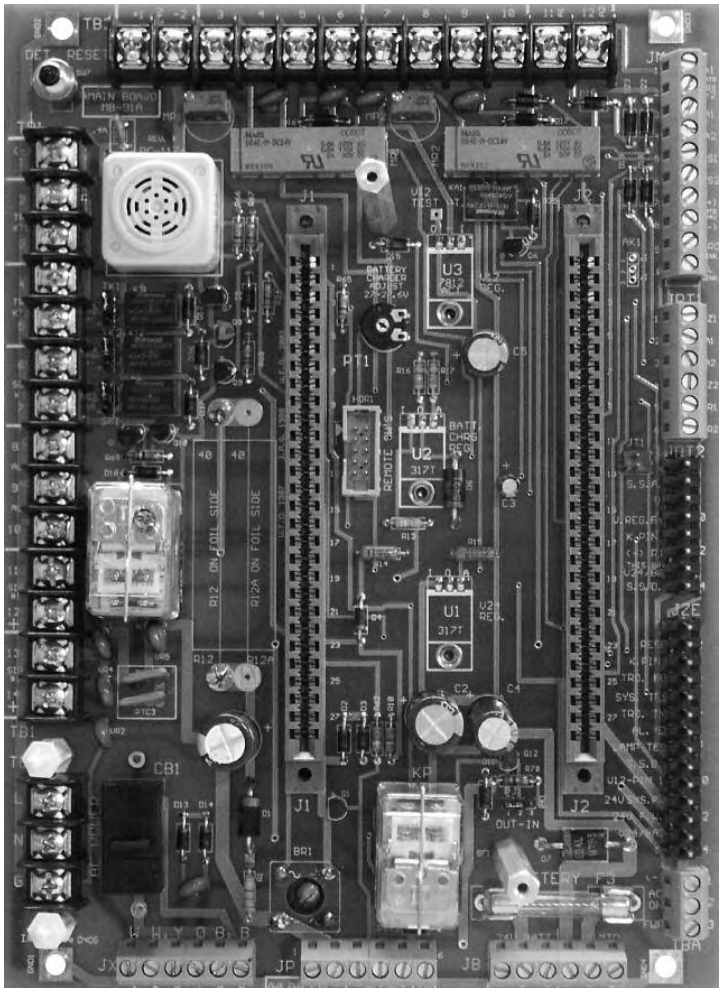
MAIN BOARD DISPLAY PANEL



MAIN BOARD
MB-91A/M



Note: Polarity of Notification Appliance circuits shown in Alarm Condition.



Transform connections Battery connections

Main Board - MB-91A/M

MB-91A Variations

MB-91A	Standard main board supporting non-metered Class A/B detection circuits
MB-91A/M	Metered main board supporting Class A/B detection circuits with Alarm point location meter

System Control Switches

SYS. TEST	System test button: Press and hold for a minimum of 3 seconds. This simulates an ALARM condition in all detection and supervisory zones. This test feature is only offered for systems **without** solenoid releasing and must be specifically asked for during purchasing.
SYS. RST.	System reset button. Press to reset system from ALARM condition.
AL. SIL.	Alarm silence button. Press to silence notification appliance devices activated by ALARM condition.
TRO. SIL.	Trouble/Supervisory alarm silence button. Press to silence activated common trouble signal (pulsing buzzer) or supervisory alarm signal (steady buzzer).
LAMP/TRO TEST	Lamp and trouble test button. Press to test indicator lamps and system trouble signaling.
METER SWITCH	Meter read switch. Press and hold to read distance (ft/m) to alarm actuation point of Protectowire zone in alarm. See Option A – Protectowire alarm point location meter
Note: The MB-91A/M (main board) is a host to the CC-91A/NT (Control Card) and ZC-91A (Zone Card). Controls specified and indicators specified below are not located on the MB-91A/M, but are located on the CC-91ANT and ZC-91A. See reference pages dedicated to the above stated cards for more information on their functions and configurations.	

System Indicators

AC ON	Green	AC Power indicator. Panel AC voltage present.
SYS. ALARM	Red	System alarm indicator. Activated when any zone ALARM occurs.
SYS. TRO./ SUP. SIG.	Yellow	System trouble indicator. Flashing when system TROUBLE exists. Steady when system SUPERVISORY ALARM condition exists.
AL. SIL.	Yellow	Alarm silenced indicator. Flashing when alarm notification appliance circuits are silenced.
AL. OPEN	Yellow	Alarm notification appliance circuit open indicator. On when open exists in circuit.
AL. SHORT	Yellow	Alarm notification appliance circuit short indicator. On when short exists in circuit.
BATT. LOW	Yellow	Battery low indicator. On when batteries voltage level is below allowed minimum.
BATT. OUT	Yellow	Battery out indicator. On when batteries voltage are disconnected or above normal operating voltage.
GND. FAULT	Yellow	System ground fault indicator. On when undesirable positive or negative current leakage occurs to ground from DC power supply of system. Not available with Option “H”
ZONE # ALARM	Red Yellow	(Red) Zone alarm indicator. On in respect to each zones alarm condition. (Yellow) Supervisory Zone alarm indicator. On in respect to a supervisory zone alarm condition.
ZONE # TROUBLE	Yellow	Zone trouble indicator. On in respect to each zones trouble condition.
BUZZER	TBZ	Trouble buzzer. Pulsating audible indication for all trouble conditions. Steady audible indication for all supervisory alarm conditions.

Serviceable components

F3	6 amp (3AG) fuse standard. 10 amp (3 AG) fuse for systems employing auxiliary power supply.
CB1	2.3 amp AC circuit breaker. Panel primary power, 120 VAC or 240 VAC 50/60 Hz.

Main Board MB-91A/M - Field Wiring

Common Trouble Contacts	1 amp @ 24 VDC, Resistive load 2 sets available. See Option "S" page for silencable & non-silenceable operation
Common Supervisory Contacts	1 amp @ 24 VDC, Resistive load 1 set available (non-silenceable)
Common Alarm Contacts	3 amps @ 30 VDC, Resistive load 1 set available (silenceable)
Notification Appliance Circuits	2 amps per circuit 3 amps maximum combined @ 19 - 32.6V FWR
Note: Notification Appliance Circuits current rating may be reduced Depending on each systems current requirements. Reference the Installation Wiring Diagram (IWD) for individual systems actual ratings. Reference Data Sheet DS-9066 for more information	
AC Power Connections	120 VAC 50/60 Hz, 175 Volt Amps Standard. 240 VAC 50/60 Hz, 175 Volt Amps (available)

REFERENCE FW-1408 LOCATED ON INSIDE OF CABINET DOOR FOR TROUBLE/SUPERVISORY CONTACT POSITIONS & JUMPER SETTINGS

*NON-SILENCEABLE WITH B2 JUMPER ON CC-91A IN THE 1-2 (NON-SIL) POSITION

COMMON (-)

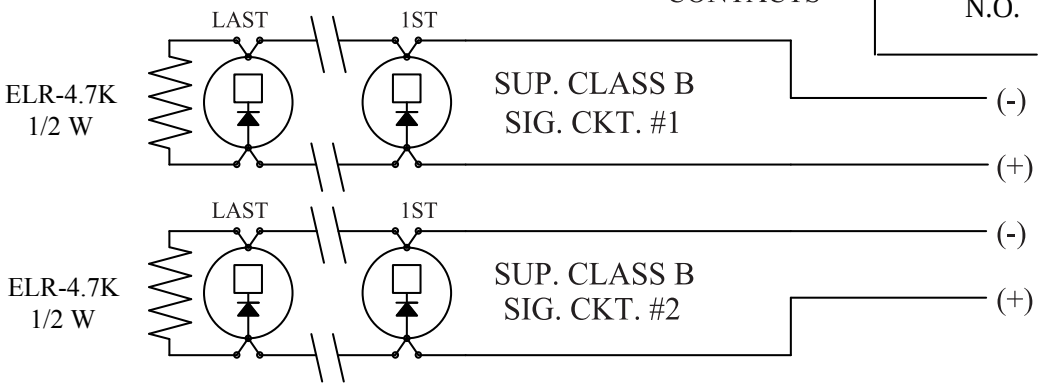
*SILENCEABLE TROUBLE CONTACTS — N.O. / N.C., COM.

SILENCEABLE TROUBLE CONTACTS — N.O. / N.C., COM.

NON-SILENCEABLE SUPERVISORY CONTACTS — N.O. / N.C., COM.

SILENCEABLE ALARM CONTACTS — COM., N.C., N.O.

Standard Class B Alarm Notification Appliance Circuits (2)

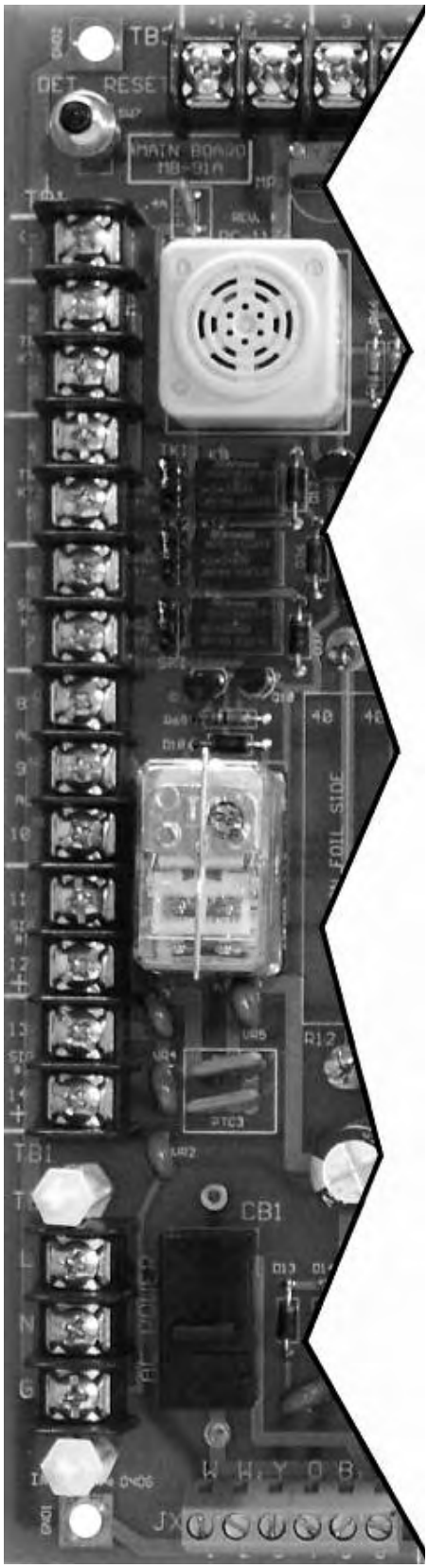


Note: Polarity of Notification Appliance Circuits shown in Alarm Condition.

For Class A alarm notification appliance circuits, reference Option "T" page of this manual.

SUPERVISED
120VAC 50/60Hz
1.75 AMP. MAX.
or
240VAC 50/60Hz
0.85 AMP. MAX.

Main Board MB-91A/M



Transformer Connections

Main Board MB-91A/M Field Wiring
Initiating Device Circuits

Class A (NFPA Style D)/Class B (NFPA Style A and B)

Voltage Standby	22VDC nominal, power limited
Current to ensure alarm	15 mA (1K ohm loop resistance minimum)
Short circuit current	35 mA
Supervision current	4.5 mA
End-of-line resistor	4.7 K ohm 1/2 Watt (Class B only)
Maximum feed cable resistance	100 ohms. Feed cable may consist of any combination of Protectowire or copper feed
Ground Fault Impedance rating	Less than 2.2K ohms impedance

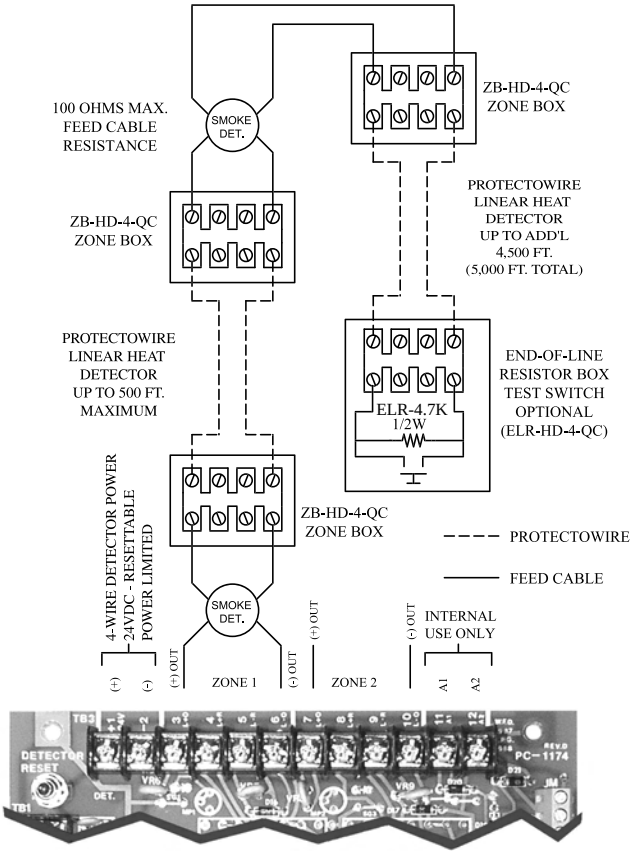
Use the following compatible devices or devices approved by The Protectowire Company, Inc.
- Up to 5,000 ft. of PROTECTOWIRE per circuit.
- Any combination of normally open contact devices.
- Up to (30) Two-Wire Smoke Detectors per circuit.
- Smoke Detectors NS-series #SLR-24, #SIJ-24, #SLR-24H
- Detector Identifier - HD-3 Base Identifier - HB-3

Note: Smoke detectors shall not be employed on intrinsically safe detection circuits.
Power limited wiring ***must*** be isolated from non-power limited wiring.

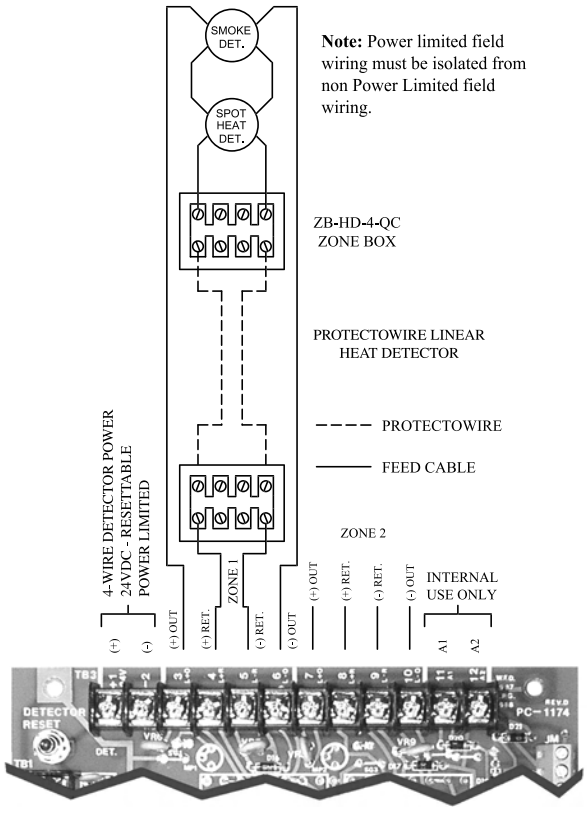
4-WIRE DETECTOR POWER

24VDC, 200 mA Max. (Power Limited, Non-Supervised). For supervision see 4-wire detector power supervision section of this manual. Source is resettable by depressing the "Detector Reset" button located on the top left corner of the main board.
Note: It is assumed that 4-wire detector power is not utilized when the system current capacity is calculated. When it is employed, deduct its current load (200 mA Max.) from the available alarm device current for the system. Used for Special Application purposes. *See Installation wiring diagram (IWD).*

TYPICAL CLASS B DETECTION
(NFPA STYLES A & B)



TYPICAL CLASS A DETECTION
(NFPA STYLE D)



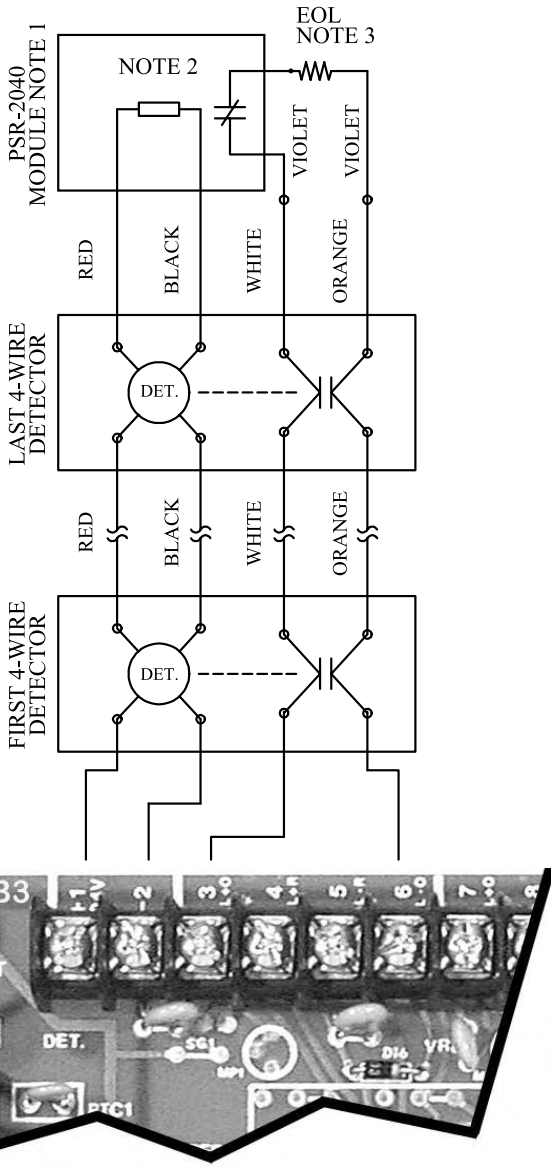
4-Wire Detector Power Supervision

Description - Supervision of power to 4-wire detectors is necessary to ensure their operation. Supervision is accomplished by installing a Power Supervisory Relay (PSR), Model PSR-2040 or its equivalent after the last detector. The relay contacts are normally closed when power is present at the last detector. These contacts are wired in series with the supervised detection circuit. A loss of power due to a break (open) in the 4-wire detector power wiring will allow the Power Supervisory Relay to *de-energize* opening the closed contact and causing a trouble in the detection circuit.

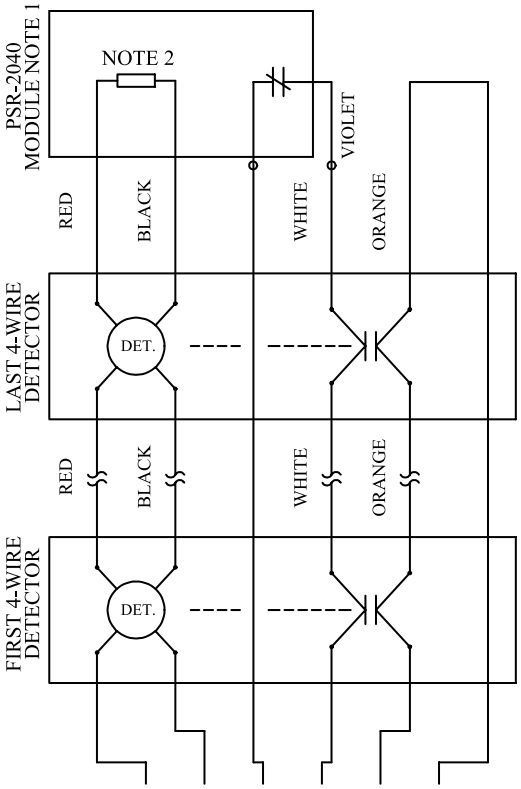
Notes:

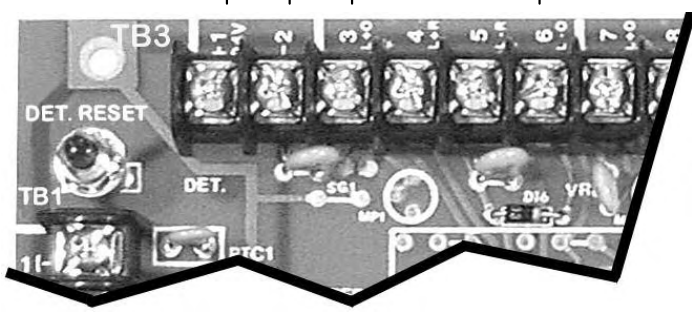
1. PSR-2040 Power Supervisory Relay shown with relay in the normally energized supervisory state (closed).
2. Install Power Supervisory Relay in the last detector back box.
3. ELR-4.7K - End-of-line device supplied with the control panel.
4. Some 4-wire detection devices provide their own power supervision. For these types of devices, a power supervisory relay may not be required.

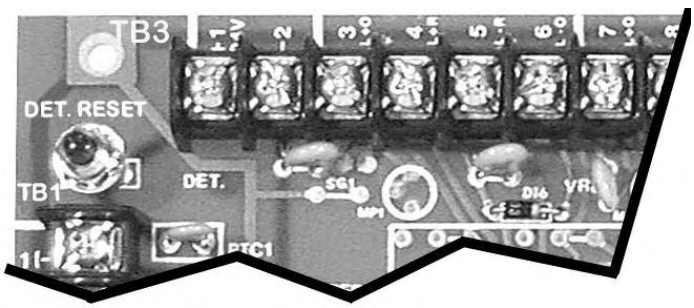
TYPICAL MULTIPLE DETECTOR WIRING, CLASS B SUPERVISED DETECTION CIRCUIT



TYPICAL MULTIPLE DETECTOR WIRING, CLASS A SUPERVISED DETECTION CIRCUIT



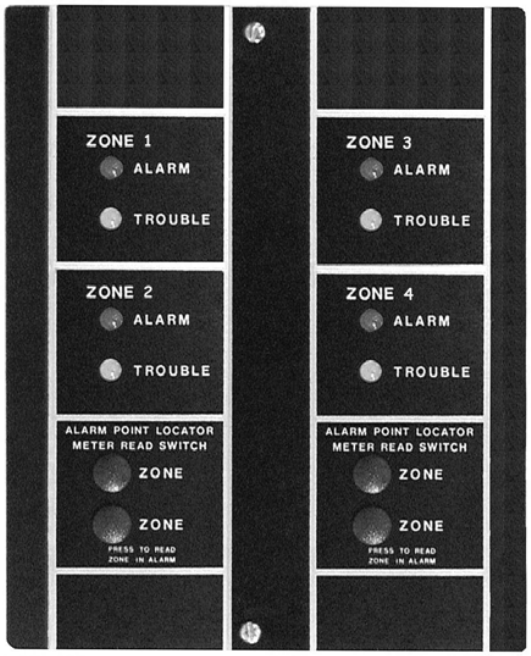




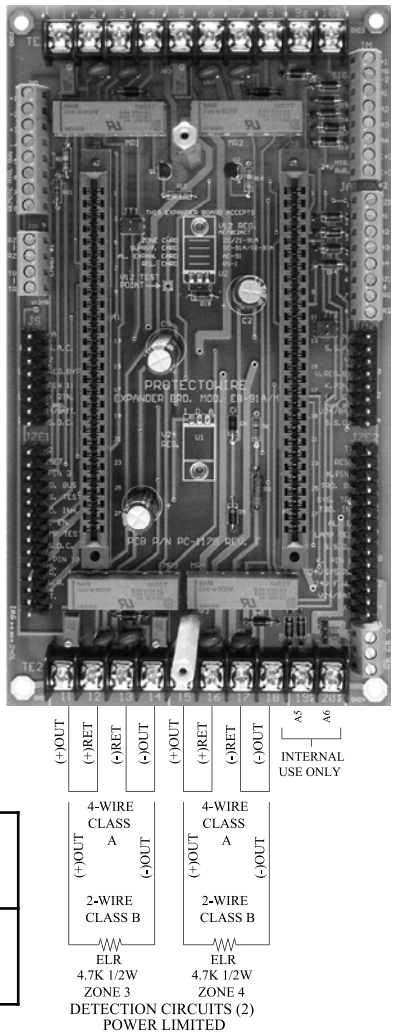
Main Board – MB-91A

Expander Board - EB-91A/M

The zone expander board can accommodate up to (4) initiating device zones. Two zone cards per expander board with (2) initiating device zones per card. Zones can be implemented as Class A/B detection, waterflow or switch supervisory circuits depending on the card type being utilized. It can also accommodate (2) alarm notification appliance cards (AE-91) with (1) notification appliance circuit per card.



EB-91A Display Panel



Expander Board

EB-91A Variations:

EB-91A	Standard expander board: Used to increase system capabilities. Accommodates up to (2) cards
EB-91A/M	Metered expander board: Used to increase system capabilities and compatible with alarm point location meter. Accommodates up to (2) cards

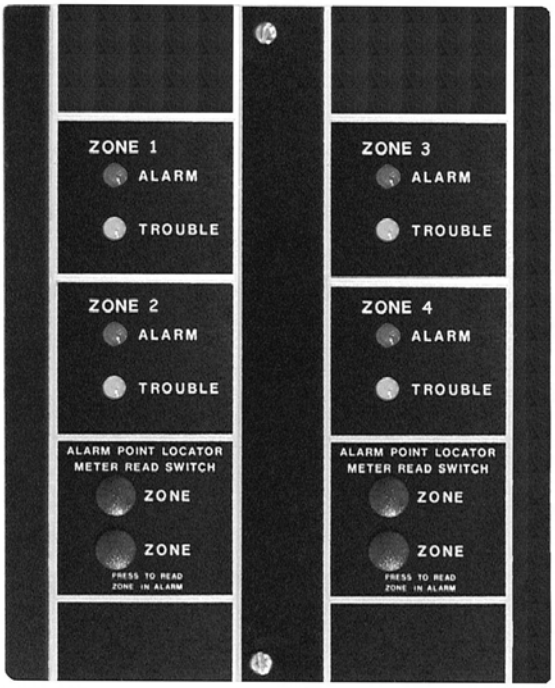
ZC-91A	Standard system zone card: Contains (2) Detection Circuits per card.
ZC-91AM	Metered system zone card: Contains (2) Detection Circuits per card (Metered zone card requires EB-91AM)
ZC-91AW	Waterflow zone card: Contains (2) Detection Circuits per card.
SC-91A	Switch Supervisory zone card: Contains (2) Detection Circuits per card.
SC-91ANL	Non-Latching switch supervisory zone card: Contains (2) Detection Circuits per card.
***AE-91**	Alarm Notification Appliance circuit card: Contains (1) Alarm Notification Appliance circuit per card.
****RS-1**	Solenoid release circuit card: Contains (1) Solenoid Release Circuit & (1) Detection Circuit per card.

* For zone field wiring see Expander Board field wiring page of manual. For AE-91 field wiring see Option “U” page of this manual.
Also reference the Installation Wiring Diagram (IWD)

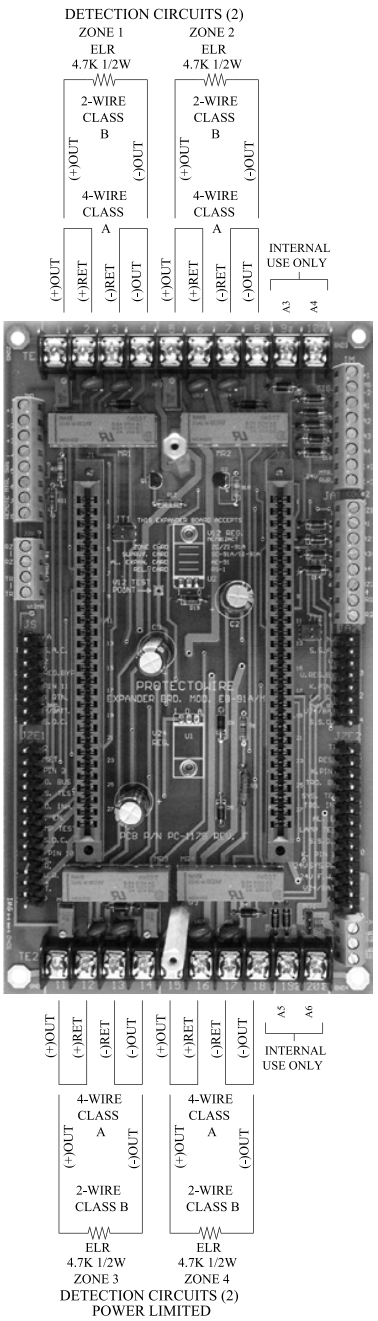
** For solenoid circuit field wiring see RS-1 field wiring page of this manual,
Also reference the Installation Wiring Diagram (IWD) **APPLICABLE FOR UL LISTED SYSTEMS ONLY**

Expander Board - EB-91A/M

The zone expander board can accommodate up to (4) initiating device zones. Two zone cards per expander board with (2) initiating device zones per card. Zones can be implemented as Class A/B detection, waterflow or switch supervisory circuits depending on the jumper configuration of the ZC-91A card. The Expander Board can also accommodate (2) Alarm B Notification Control cards (AE-91) with (1) Notification Appliance circuit per card.



EB-91A/M Display Panel



Expander Board

EB-91A Variations

EB-91A	Standard expander board: Used to increase system capabilities. Accommodates up to (2) cards
EB-91A/M	Metered expander board: Used to increase system capabilities and compatible with alarm point location meter. Accommodates up to (2) cards

ZC-91A	Standard system zone card: Contains (2) Detection Circuits per card.
ZC-91AM	Metered system zone card: Contains (2) Detection Circuits per card (Metered zone card requires EB-91AM)
ZC-91AW	Waterflow zone card: Contains (2) Detection Circuits per card.
ZI-91A	Intrinsic zone card: Contains (2) Intrinsic Detection Circuits per card.
SC-91A	Switch Supervisory zone card: Contains (2) Detection Circuits per card.
SC-91ANL	Non-Latching switch supervisory zone card: Contains (2) Detection Circuits per card.
***AE-91**	Alarm Notification Appliance circuit card: Contains (1) Alarm Notification Appliance circuit per card.
****RS-1**	Solenoid release circuit card: Contains (1) Solenoid Release Circuit & (1) Detection Circuit per card.

*For zone field wiring see Expander Board field wiring page of this manual. For AE-91 field wiring see Option "U" page of this manual. For dual temperature zone card field wiring see ZC-95 field wiring page of this manual.
**For solenoid circuit field wiring see RS-1 field wiring page of this manual.
Also reference the Installation Wiring Diagram (IWD).

APPLICABLE FOR FM APPROVED SYSTEMS ONLY

Expander Board EB-91A/M Field Wiring
Initiating Device Circuits

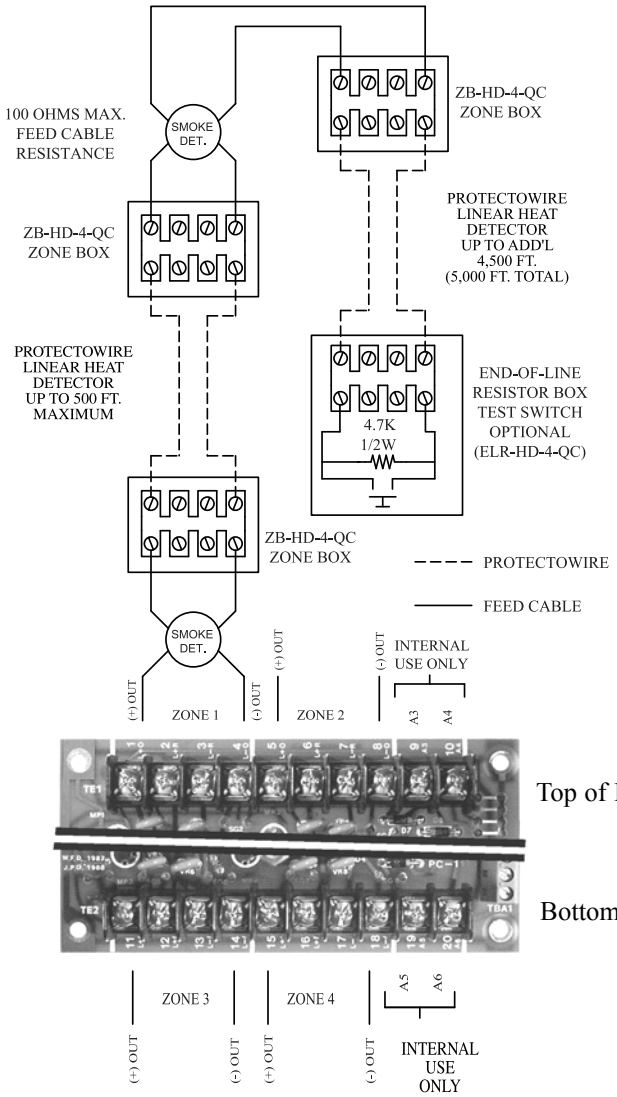
Class A (NFPA Style D)/Class B (NFPA Style A and B)

Voltage Standby	22VDC nominal, power limited
Current to insure alarm	15mA (1K ohm loop resistance minimum)
Short circuit current	35mA
Supervision current	4.5mA
End-of-line resistor	ELR-4.7K, 1/2 Watt (Class B only)
Maximum feed cable resistance	100 ohms. Feed cable may consist of any combination of PROTECTOWIRE or copper feed

Use the following compatible devices or devices approved by The Protectowire Company, Inc.
- Up to 5,000 ft. of PROTECTOWIRE per circuit.
- Any combination of normally open contact devices.
- Up to (30) Two-Wire Smoke Detectors per circuit.
- Smoke Detectors NS-series #SLR-24, #SIJ-24, #SLR-24H
- Detector Identifier - HD-3 Base Identifier - HB-3

Note: Smoke detectors shall not be employed on intrinsic safe detection circuits.
Power Limited wiring *must* be isolated from Non-Power Limited Wiring.

TYPICAL CLASS B DETECTION
(NFPA STYLES A & B)

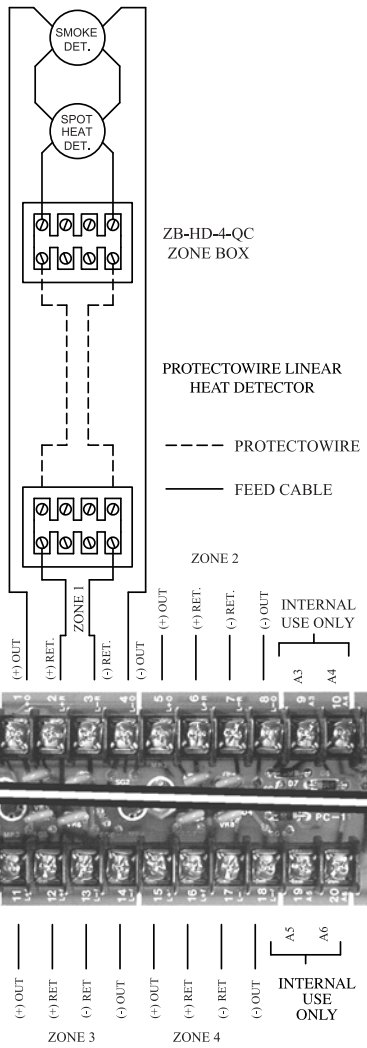


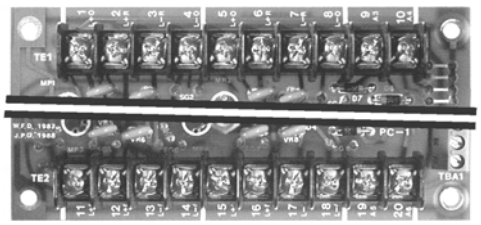
Top of EB-91A

Bottom of EB-91A

TYPICAL CLASS A DETECTION
(NFPA STYLE D)

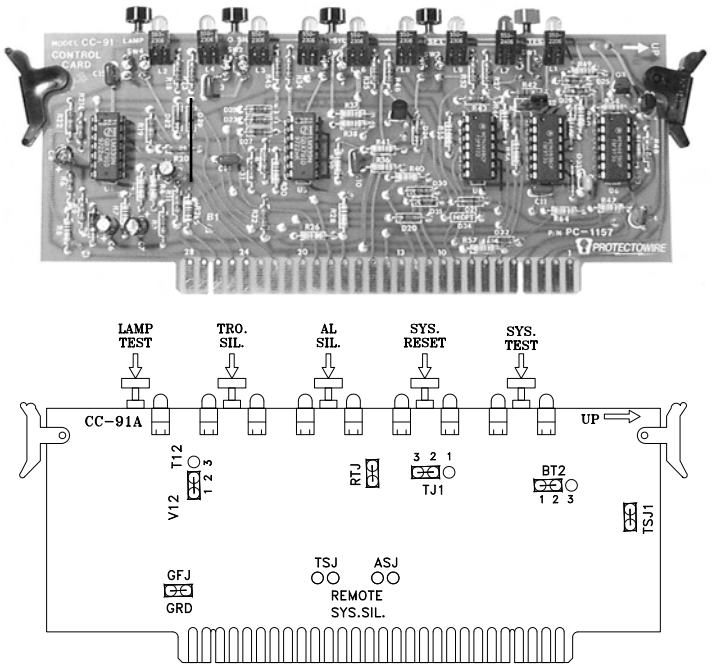
(NFPA STYLE D)



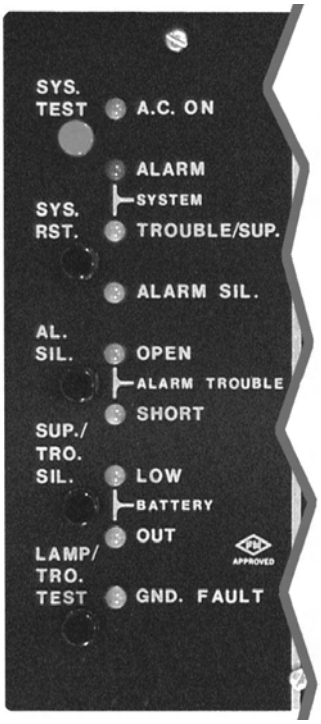


Control Card Module - CC-91A

The Control Card CC-91A provides system controls and indicator for the FS2000 Series system. This card plugs into the Main Board MB-91A/M printed circuit board left side card slot.



System control switches, lamp indicators and signal monitoring are managed with this module. Plug-in design allows for quick replacement during field repair. Used in conjunction with the Main Board (MB-91A). Standard control card module is designated as CC-91ANT. This card eliminates the possibility of accidental releasing by removing the "SYS. TEST" button.



CC-91A Display Panel

CC-91A Variations:

CC-91A	Control card module with "SYS.TEST" switch. This card must be specifically requested at time of purchase
CC-91ANT	No test switch control card module: For use with releasing system where test feature is not desired (Standard)

CC-91A Control Switches:

SYS. TEST	System test button: Press and hold for a minimum of 3 seconds. Simulates ALARM condition in all detection and supervisory zones. (Only available when specified on systems without solenoid release) *See warning
SYS. RESET	System Reset button: Press to reset system from ALARM condition.
AL. SIL	Alarm Silence button: Press to silence Alarm Notification Appliance devices activated by ALARM condition
SUP./TRO. SIL.	Trouble/Supervisory alarm silence button: Press to silence activated common trouble signal (pulsing buzzer) or supervisory alarm signal (steady buzzer)
LAMP/TRO. TEST	Lamp and trouble test button: Press to test lamp indicators and system trouble signaling
*Warning: Disconnect all releasing devices and/or equipment shutdown prior to testing system. See Testing & Maintenance section	

CC-91A Indicators:

AC ON	Green	AC Power indicator: ON when panel AC voltage is present
SYSTEM ALARM	Red	System alarm indicator: Activated when any zone ALARM occurs
SYSTEM TROUBLE/ SUP.	Yellow	System trouble indicator: Flashing when system TROUBLE exists. Steady when system SUPERVISORY ALARM condition exists
ALARM SIL.	Yellow	Alarm silenced indicator: Flashing when Alarm Notification A2728ppliance circuits are silenced.
ALARM OPEN	Yellow	Alarm notification appliance circuit OPEN indicator: ON when OPEN exists in circuit.
ALARM SHORT	Yellow	Alarm notification appliance circuit SHORT indicator: ON when SHORT exists in circuit.
BATTERY LOW	Yellow	Battery low indicator: ON when battery voltage level is below allowed minimum.
BATTERY OUT	Yellow	Battery out indicator: ON when battery disconnect or above normal operating voltage below
GND. FAULT	Yellow	System ground fault indicator: ON when undesirable positive or negative current leakage occurs to grd from DC power supply of system. Not available with intrinsic safety barriers (Option H)

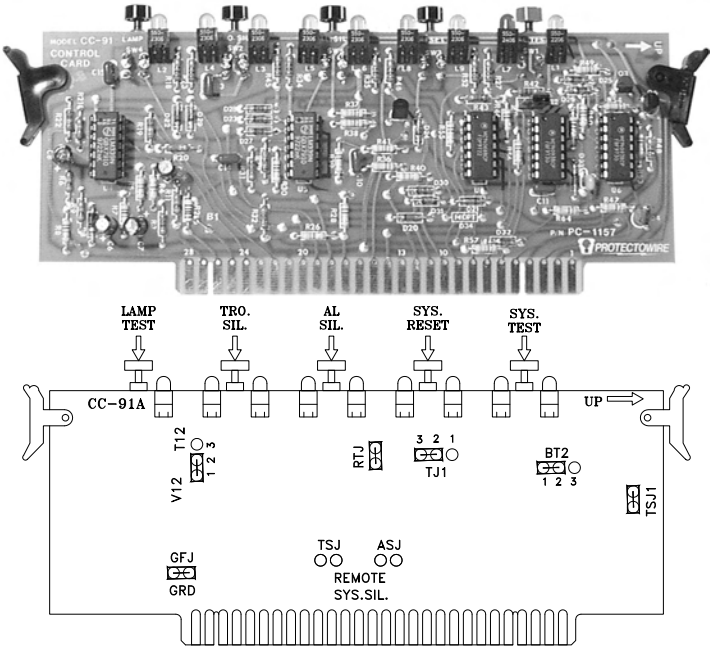
CC-91A Jumper Settings:

GFJ	Placed across GFH terminals 1 & 2 to enable ground fault detection. Jumper removed ONLY when diode shunt type intrinsic safety barriers are employed
ASJ & TSJ	Jumpers are installed when option Z is part of panel design. These jumpers allow the Alarm (ASJ) and Trouble (TSJ) signals to be silenced.
BT2J	Allows the common trouble output drive to be either Silenceable or Non-Silenceable. To conserve battery power this jumper is typically installed in the Non-Silenceable position.

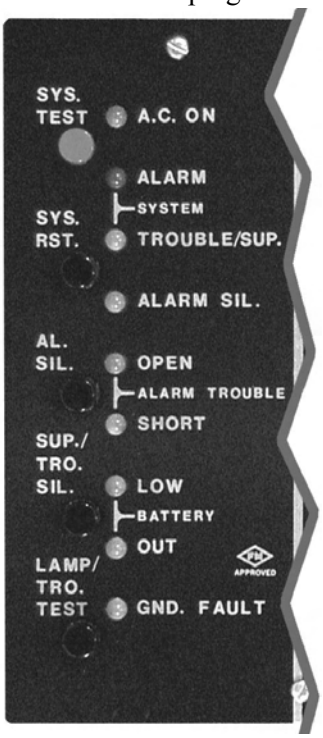
APPLICABLE FOR UL LISTED SYSTEMS ONLY

Control Card Module - CC-91A

The Control Card CC-91A provides system control and indicators for the FS2000 Series system. This card plugs into the Main Board MB-91A/M printed circuit board left side card slot.



System control switches, lamp indicators and signal monitoring are managed with this module. Plug-in design allows for quick replacement during field repair. Used in conjunction with the Main Board (MB-91A). Standard control card module is designated as CC-91ANT. This card eliminates the possibility of accidental releasing by removing the "SYS. TEST" button.



CC-91A Display Panel

CC-91A Variations:

CC-91A	Control card module with "SYS.TEST" switch. This card must be specifically requested at time of purchase
CC-91ANT	No test switch control card module: For use with releasing system where test feature is not desired (Standard)
CC-91AI	Intrinsic control card module: For use with intrinsically safe detection circuits (Reference Option H)
CC-91AINT	Intrinsic, no test control card: For use with releasing system where test feature is not desired & intrinsically safe circuits (Opt H)

CC-91A Control Switches:

SYS. TEST	System test button: Press and hold for a minimum of 3 seconds. Simulates ALARM condition in all detection and supervisory zones. (Only available when specified on systems without solenoid release) *See warning
SYS. RESET	System Reset button: Press to reset system from ALARM condition.
AL. SIL	Alarm Silence button: Press to silenceAlarm Notification Appliance devices activated by ALARM condition
SUP./TRO. SIL.	Trouble/Supervisory alarm silence button: Press to silence activated common trouble signal (pulsing buzzer) or supervisory alarm signal (steady buzzer)
LAMP/TRO. TEST	Lamp and trouble test button: Press to test lamp indicators and system trouble signaling
*Warning: Disconnect all releasing devices and/or equipment shutdown prior to testing system. See Testing & Maintenance section	

CC-91A Indicators:

AC ON	Green	AC Power indicator: ON when panel AC voltage is present
SYSTEM ALARM	Red	System alarm indicator: Activated when any zone ALARM occurs
SYSTEM TROUBLE/ SUP.	Yellow	System trouble indicator: Flashing when system TROUBLE exists. Steady when system SUPERVISORY ALARM condition exists
ALARM SIL.	Yellow	Alarm silenced indicator: Flashing when Alarm Notification Appliance circuits are silenced.
ALARM OPEN	Yellow	Alarm notification appliance circuit OPEN indicator: ON when OPEN exists in circuit.
ALARM SHORT	Yellow	Alarm notification appliance circuit SHORT indicator: ON when SHORT exists in circuit.
BATTERY LOW	Yellow	Battery low indicator: ON when battery voltage level is below allowed minimum.
BATTERY OUT	Yellow	Battery out indicator: ON when battery disconnect or above normal operating voltage below
GND. FAULT	Yellow	System ground fault indicator: ON when undesirable positive or negative current leakage occurs to grd from DC power supply of system. Not available with intrinsic safety barriers (Option H)

CC-91A Jumper Settings:

GFJ	Placed across GFH terminals 1 & 2 to enable ground fault detection. Jumper removed ONLY when diode shunt type intrinsic safety barriers are employed
ASJ & TSJ	Jumpers are installed when option Z is part of panel design. These jumpers allow the Alarm (ASJ) and Trouble (TSJ) signals to be silenced.
BT2J	Allows the common trouble output drive to be either Silenceable or Non-Silenceable. To conserve battery power this jumper is typically installed in the Non-Silenceable position.

APPLICABLE FOR FM APPROVED SYSTEMS ONLY

Zone Card Modules - ZC-91A

(For Detection Applications)

DESCRIPTION:

The zone card ZC-91A provides two Class A/B alarm initiating device circuits configured for alarm monitoring. Each zone is individually equipped with alarm (red) and trouble (yellow) indicators for immediate status identification. This card plugs into the second edge connector slot of the Main Board (MB-91A/M) and/or any Expander Board module (EB-91A/M)

Operation:

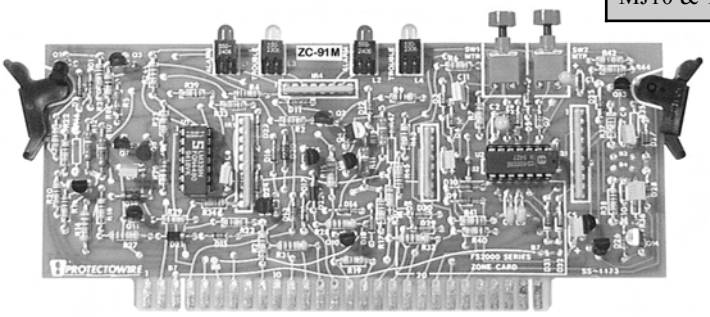
Alarm - A shorted detection circuit will initiate the panel into an alarm condition. The detection zone "ALARM" (red) indicator will light steady and the "SYS. ALARM" (red) indicator on the Control Card (CC-91A) will activate. The common alarm contacts on the MB-91A will transfer, and both general alarm Notification Appliance Circuits will operate.

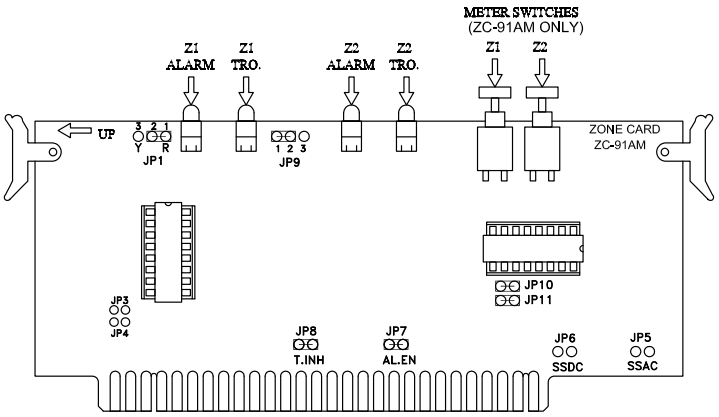
Alarm Point Location - In metered systems, once a zone is in alarm depress and hold down the respective zone switch (SW1 or SW2) to display zone alarm point location of corresponding zone. Depressing switch will transfer alarm point location onto alarm point location digital display (PWM-1000-2).

Electrical Initiating Device Circuit - IDC	
Voltage Standby	22VDC
Current to Insure Alarm	13mA
Minimum Resistance to Insure Alarm	<1.48K ohm
End of Line Device (Class B only)	ELR-4.7K, 1/2 Watt, 5%
Supervisory Current	4.7mA

ZC-91A Jumper Settings:

MJ1 & 2	Jumpers installed across terminal 1 & 2 on micro-header JP1 & JP2 todesignate initiating circuits for detection zones.
MJ3 & 4	Installed when intrinsic safety barriers (Option H) for hazardous locations are required
MJ5 thru 8	MJ5 & 6 are not installed MJ7 & 8 are installed when circuits aassigned as detection zones
MJ9	Placed across JP9 terminals 1 & 2 for trouble indications to remain active during alarm mode
MJ10 & 11	Jumpers are not required for detection zone usage.





Provides the circuitry required to operate the various Class A/B initiating devices. Designed with plug-in package for field repair ease. This card plugs into the Main or Expander board modules.

ZC-91A Display Panel

ZC-91A Variations:

ZC-91A	Standard system zone card: Provides (2) Class A/B detection circuits
ZC-91AM	Metered system zone card: Provides (2) Class A/B detection circuits compatible with alarm point location meter.

ZC-91A Indicators:

ALARM	Red	Zone alarm indicator: Activates with respect to each zone in ALARM condition
TROUBLE	Yellow	Zone trouble indicator: Activates in respect to each zone in TROUBLE condition

ZC-91A Control Switches:

Meter Switch Zone 1	Meter read switch Zone 1: Press and hold to read distance (ft/m) to alarm actuation point of Protectowire zone in alarm: See Option A - Protectowire alarm point location meter
Meter Switch Zone 2	Meter read switch Zone 2: Press and hold to read distance (ft/m) to alarm actuation point of Protectowire zone in alarm: See Option A - Protectowire alarm point location meter

APPLICABLE FOR UL LISTED SYSTEMS ONLY

Zone Card Module - ZC-91A

(For Detection Applications)

DESCRIPTION:

The zone card ZC-91A provides two Class A/B alarm initiating device circuits configured for alarm monitoring. Each zone is individually equipped with alarm (red) and trouble (yellow) indicators for immediate status identification. This card plugs into the second edge connector slot of the Main Board (MB-91A/M) and/or any Expander Board module (EB-91A/M)

Operation:

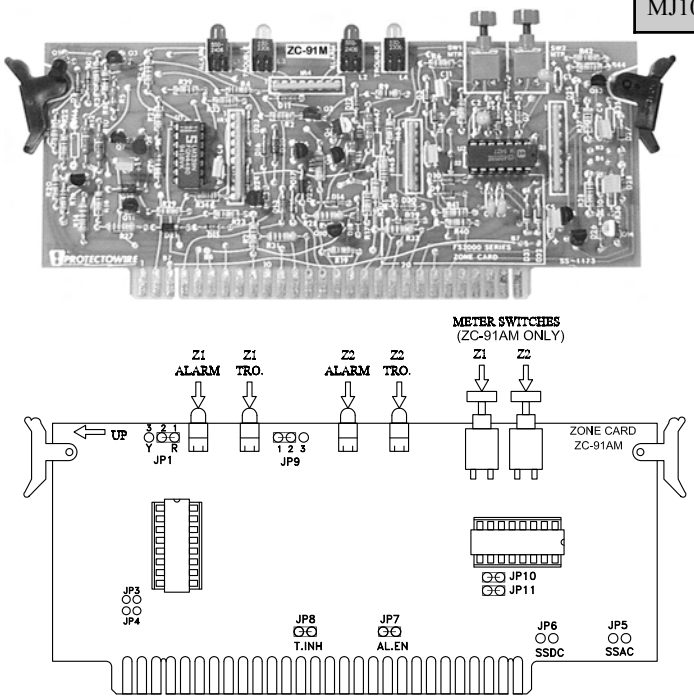
Alarm - A shorted detection circuit will initiate the panel into an alarm condition. The detection zone "ALARM" (red) indicator will light steady and the "SYS. ALARM" (red) indicator on the Control Card (CC-91A) will activate. The common alarm contacts on the MB-91A will transfer, and both general alarm Notification Appliance Circuits will operate.

Alarm Point Location - In metered systems, once a zone is in alarm depress and hold down the respective zone switch (SW1 or SW2) to display zone alarm point location of corresponding zone. Depressing switch will transfer alarm point location onto alarm point location digital display (PWM-1000-2).

Electrical Initiating Device Circuit - IDC	
Voltage Standby	22VDC
Current to Insure Alarm	13mA
Minimum Resistance to Insure Alarm	<1.48K ohm
End of Line Device (Class B only)	ELR-4.7K, 1/2 Watt, 5%
Supervisory Current	4.7mA

ZC-91A Jumper Settings:

MJ1 & 2	Jumpers installed across terminal 1 & 2 on micro-header JP1 & JP2 todesignate initiating circuits for detection zones.
MJ3 & 4	Installed when intrinsic safety barriers (Option H) for hazardous locations are required
MJ5 thru 8	MJ5 & 6 are not installed MJ7 & 8 are installed when circuits aassigned as detection zones
MJ9	Placed across JP9 terminals 1 & 2 for trouble indications to remain active during alarm mode
MJ10 & 11	Jumpers are not required for detection zone usage.



Provides the circuitry required to operate the various Class A/B initiating devices. Designed with plug-in package for field repair ease. This board plugs into Main Control or Expander board modules.

ZC-91A Display Panel

ZC-91A Variations:

ZC-91A	Standard system zone card: Provides (2) Class A/B detection circuits
ZC-91AM	Metered system zone card: Provides (2) Class A/B detection circuits compatible with alarm point location meter.
ZI-91A	Intrinsic system zone card: Provides (2) Class B detection circuits compatible with intrinsic safety barriers
ZI-91AM	Intrinsic Metered system zone card: Provides (2) Class B detection circuits compatible with intrinsic safety barriers & alarm point location meter

ZC-91A Indicators - Standard Type Zone Card:

ALARM	Red	Zone alarm indicator: Activates with respect to each zone in ALARM condition
TROUBLE	Yellow	Zone trouble indicator: Activates in respect to each zone in TROUBLE condition

ZC-91A Control Switches:

Meter Switch Zone 1	Meter read switch Zone 1: Press and hold to read distance (ft/m) to alarm actuation point of Protectowire zone in alarm: See Option A - Protectowire alarm point location meter
Meter Switch Zone 2	Meter read switch Zone 2: Press and hold to read distance (ft/m) to alarm actuation point of Protectowire zone in alarm: See Option A - Protectowire alarm point location meter

APPLICABLE FOR FM APPROVED SYSTEMS ONLY

Option “A” - PDM-1000-2
Protectowire Alarm Point Location Meter

DESCRIPTION:

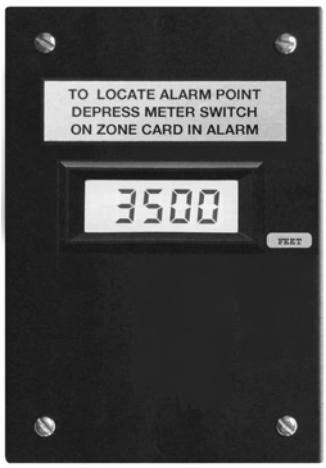
The PDM-1000-2 PROTECTOWIRE Digital Alarm Point Location Meter is designed to help locate a heat actuated point on a PROTECTOWIRE linear heat detector circuit. This meter identifies the distance in feet or meters (preset at the factory) along the detector from the start of the run to the actuated point. ***Note:*** The PDM-1000-2 is calibrated at the factory and only requires adjustment to compensate for field cable resistance at the time of installation.

Note: The Protectowire Alarm Point Location Meter is also available in a vertical housing configuration **(PDM-1000-3)**. This meter is identical to the PDM-1000-2 with the exception of orientation an allows flexibility for larger battery sizes.

PDM-1000-2

OPERATION:

When an alarm signal is received at the main control panel, depress the meter switch (see illustration below) of the zone in alarm (indicated by the lighted red LED). The meter will then display the distance to the actuated portion of the PROTECTOWIRE linear heat detector circuit.



PDM-1000-3

CALIBRATION:

The copper feed wire between the control panel and the zone (junction) box at the start of the PROTECTOWIRE run has an inherent resistance. This resistance although small compared to that of the PROTECTOWIRE, will introduce an error in the digital meter reading. The longer the feed wire, the greater the error . Adjust the meter per the following procedure to compensate for field wiring resistance.

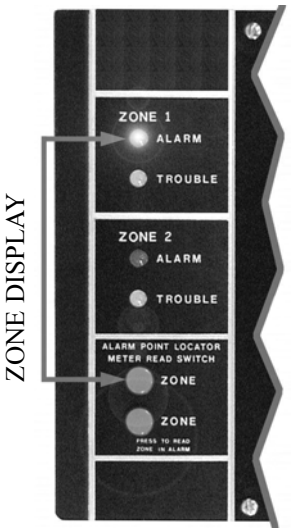
1. Disconnect all alarm and/or releasing devices connected to the control panel and apply power to the system before proceeding.

2. Connect a jumper wire across the detection circuit at the beginning of the PROTECTOWIRE run (at the zone box). ***Caution:*** This will trip the detection circuit into an alarm condition.

3. At the control panel press the meter read switch on the zone card module for the appropriate zone in alarm. The meter will display the feed cable error.

4. To cancel out (zero) this value, adjust the corresponding MP# potentiometer on the main or expander boards for the zone in alarm by using a small screwdriver to turn the potentiometer until the meter reads zero. (See below)
   Note: the positive (+) and negative (-) indicator will fluctuate when zeroed.

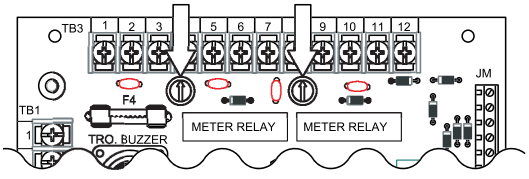
5. Repeat this procedure for all other zones containing PROTECTOWIRE linear heat detector.



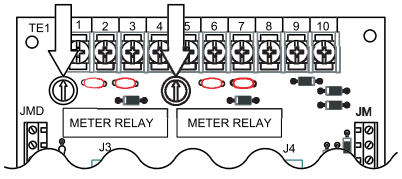
Note:

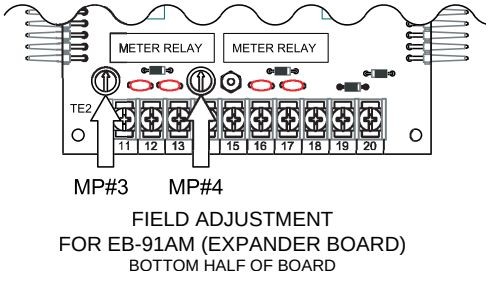
The PROTECTOWIRE digital meter is designed for reading lengths of PROTECTOWIRE linear heat detector cable installed at an ambient temperature of 70º F . Since the inner conductors of PROTECTOWIRE consist of two steel wires, the inherent cable resistance is subject to change proportionally to temperature. For each 10º F change in temperature a 1% change in total measure cable length can be expected. Using #14AWG or larger copper feed wire in detection circuits that have PROTECTOWIRE will minimize meter reading error.

FIELD ADJUSTMENT
FOR MB-91AM (MAIN BOARD)



FIELD ADJUSTMENT
FOR EB-91AM (EXPANDER BOARD)
TOP HALF OF BOARD





FIELD ADJUSTMENT
FOR EB-91AM (EXPANDER BOARD)
BOTTOM HALF OF BOARD

Option “C” - NDS-91-16X, 16 Zone Alarm Scanner

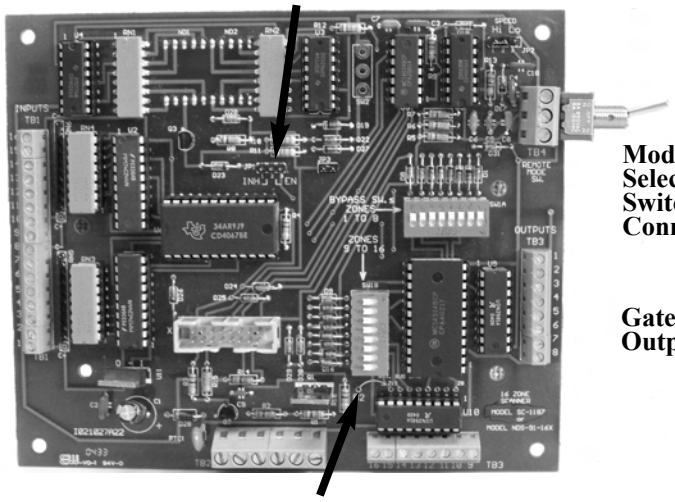
DESCRIPTION:
The NDS-91-16X Sixteen Zone Alarm Scanner identifies the zone number in conjunction with linear alarm point identification of a PROTECTOWIRE heat sensitive cable detection zone. In the automatic (AUTO) scan mode this device continually steps through all active (not bypassed) detection zones until an alarm input signal is received. Once received, the zone is identified and displayed with the alarm point location for approximately six (6) seconds; then resumes scanning for additional zones in alarm. The scanner may also be stopped at any zone and/or advanced manually. With expander modules the NDS-91-16X can scan up to a total of forty-eight (48) PROTECTOWIRE zones.

OPERATION:
While functioning in a normal standby scan (AUTO) mode the decimal point in the lower right corner of the scanner display pulses indicating proper operation.

- To interrupt scan and “lock-on” to an individual zone; toggle the mode switch to the “STOP” (center) position. The display will show the current scanned zone.
- To manually step to a zone, place the mode switch to the “STOP” position and momentarily toggle the switch to the “MANUAL” (down) position. Repeat until the display shows the desired zone number.
- To continually scan, toggle the mode switch to the “AUTO” (up) position. The display is normally inhibited during the scanning process to minimize power consumption. To change the display status, place programming jumper (see illustration) to “INHIBIT” or “ENABLE” position.
- To eliminate a zone from the scanning cycle, slide the corresponding dip switch (see illustration) to the “BYPASS” (ON) position. To reinstate a bypassed zone, slide the dip switch to the “ACTIVE” (OFF) position.
- For meter calibration (OPTION A) see Option “A” page of this manual.

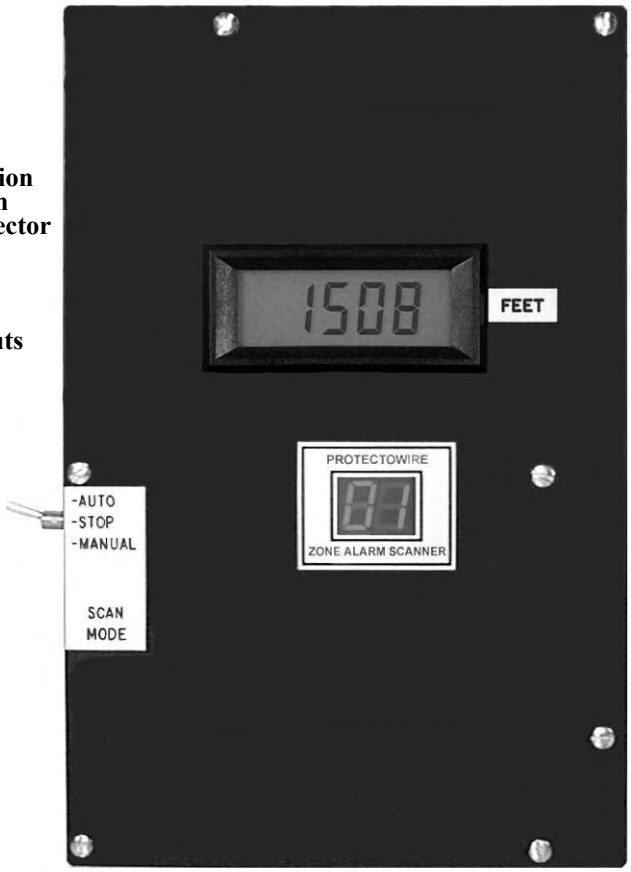
16 ZONE ALARM SCANNER CIRCUIT BOARD

Display Inhibit Jumper



To bypass a scanned zone, slide the corresponding dip switch to the on position

16 ZONE ALARM SCANNER DISPLAY ASSEMBLY



ELECTRICAL INFORMATION:

Current Display Active	55mA @ 24VDC
Current Display Blanked	37mA @ 24VDC
Scan Speed	Approximately 16 Zones/Sec

Option “D” - Waterflow Detection Card -ZC-91AW

The zone card ZC-91AW provides two Class A or Class B alarm initiating device circuits for waterflow detection monitoring. Both waterflow alarm circuits are equipped with alarm and trouble indicators for immediate off normal status identification. The waterflow card must be programmed per jumper settings noted below and plugs into the Main Board MB-91A/M and/or Expander Boards EB-91A/M printed circuit board card slots.

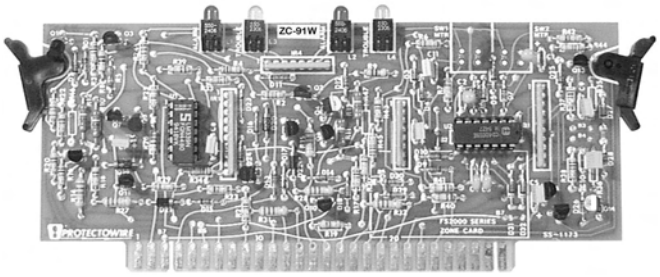
Operation:

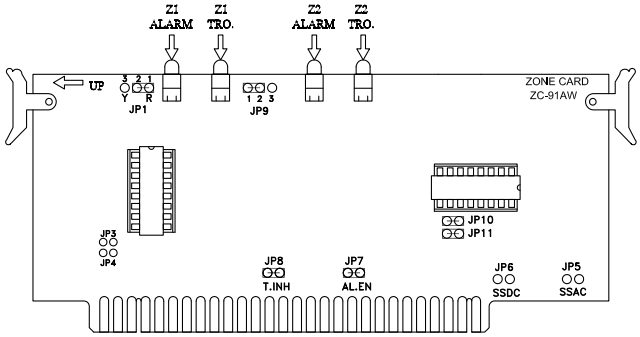
Alarm - A shorted waterflow device will initiate the circuit into an alarm condition. Detection devices will cause the system to function in the fire alarm mode of operation. The on-card zone “ALARM” (red) indicator will light steady; the “SYSTEM ALARM” (red) indicator on the Control Card CC-91A will light steady. The common alarm contacts on the MB-91A will transfer, and both Notification Appliamcel Circuits will operate.

Trouble - An open in the detection loop will initiate the circuit into a trouble condition. The on-card zone “TROUBLE” (yellow) indicator will activate as well as the “SYSTEM TROUBLE/SUP” indicator on the control card CC-91A will flash; the system trouble buzzer will pulse.

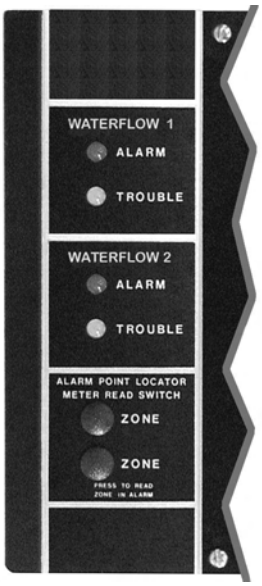
ZC-91AW Indicators

ALARM	Red	Zone alarm indicator: Activates with respect to each zone in ALARM condition
TROUBLE	Yellow	Zone trouble indicator: Activates in respect to each zone in TROUBLE condition





Provides the circuitry required to operate the Class A/B waterflow initiating devices. Designed with plug in package for field repair ease. This card plugs into the Main or Expander board modules



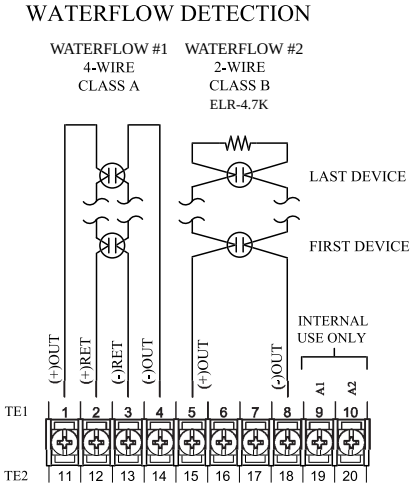
ZC-91AW Display Panel

ZC-91AW Jumper Settings

MJ1 & 2	Placed across JP1 & 2 terminals 1 & 2 when circuits are employed as waterflow detection zones.
MJ7 & 8	Place jumper across JP7 & JP8 to make detection circuits assigned for waterflow alarm
MJ9	Placed across JP9 terminals 1 & 2 for trouble indications to remain active during alarm mode
MJ10 & 11	JP10 & JP11 must always be installed for circuits assigned for waterflow alarm

Electrical Initiating Device Circuit - IDC	
Voltage Standby	22VDC
Current to Insure Alarm	13mA
Minimum Resistance to Insure Alarm	<1.48K ohm
End of Line Device (Class B only)	ELR-4.7K, 1/2 Watt, 5%
Supervisory Current	4.7mA

ZC-91AW Field Wiring



Terminations on expander board terminals TE1 or TE2

APPLICABLE FOR UL LISTED SYSTEMS ONLY

Option “D” - Waterflow Detection Card -ZC-91AW

The zone card ZC-91AW provides two Class A or Class B alarm initiating device circuits for waterflow detection monitoring. Both waterflow alarm circuits are equipped with alarm and trouble indicators for immediate off normal status identification. The waterflow card must be programmed per jumper settings noted below and plugs into the Main Board MB-91A/M and/or Expander Boards EB-91A/M printed circuit board card slots.

Operation:

Alarm - A shorted waterflow device will initiate the circuit into an alarm condition. Detection devices will cause the system to function in the fire alarm mode of operation. The on-card zone “ALARM” (red) indicator will light steady; the “SYSTEM ALARM” (red) indicator on the Control Card CC-91A will light steady. The common alarm contacts on the MB-91A will transfer, and both Notification Appliance Circuits will operate.

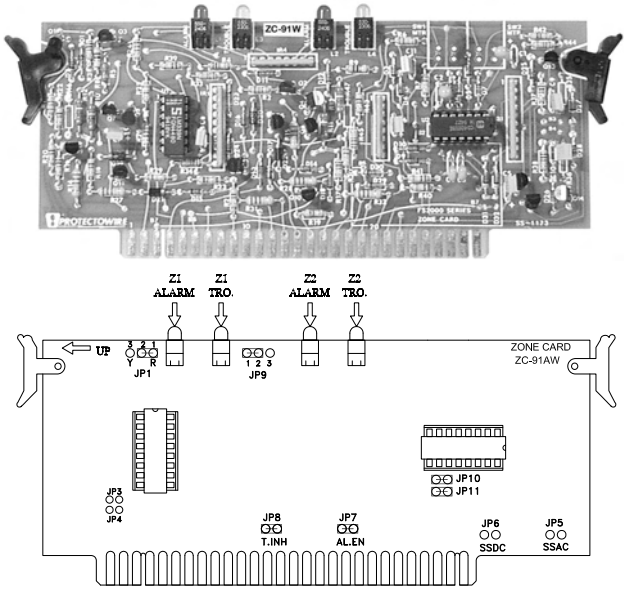
Trouble - An open in the detection loop will initiate the circuit into a trouble condition. The on-card zone “TROUBLE” (yellow) indicator will activate as well as the “SYSTEM TROUBLE/SUP” indicator on the control card CC-91A will flash; the system trouble buzzer will pulse.

ZC-91AW Indicators

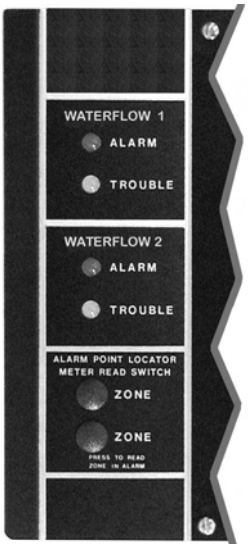
ALARM	Red	Zone alarm indicator: Activates with respect to each zone in ALARM condition
TROUBLE	Yellow	Zone trouble indicator: Activates in respect to each zone in TROUBLE condition

ZC-91AW Variations

ZC-91AW	Standard system zone card: Provides (2) Class A/B detection circuits
ZI-91AW	Intrinsic Waterflow zone card: Provides (2) Class B waterflow detection circuits compatible with Intrinsic Safety barriers.



Provides the circuitry required to operate the Class A/B waterflow initiating devices. Designed with plug in package for field repair ease. This card plugs into the Main or Expander board modules



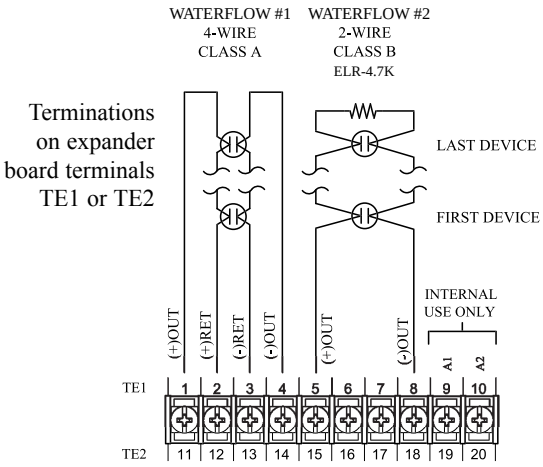
ZC-91AW Jumper Settings

MJ1 & 2	Placed across JP1 & 2 terminals 1 & 2 when circuits are employed as waterflow detection zones.
MJ7 & 8	Place jumper across JP7 & JP8 to make detection circuits assigned for waterflow alarm
MJ9	Placed across JP9 terminals 1 & 2 for trouble indications to remain active during alarm mode
MJ10 & 11	JP10 & JP11 must always be installed for circuits assigned for waterflow alarm

Electrical Initiating Device Circuit - IDC	
Voltage Standby	22VDC
Current to Insure Alarm	13mA
Minimum Resistance to Insure Alarm	<1.48K ohm
End of Line Device (Class B only)	ELR-4.7K, 1/2 Watt, 5%
Supervisory Current	4.7mA

ZC-91AW Field Wiring

WATERFLOW DETECTION



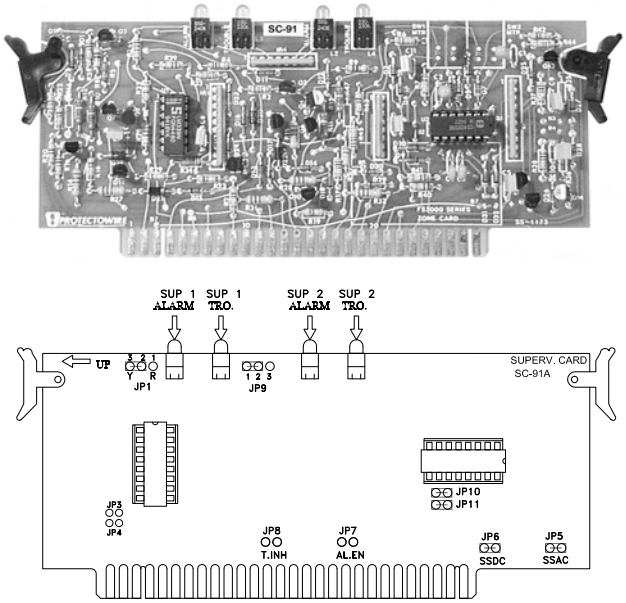
APPLICABLE FOR FM APPROVED SYSTEMS ONLY

Option “E” - Switch Supervisory Card - SC-91A

DESCRIPTION:
The supervisory card SC-91A provides two Class A/B alarm initiating supervisory circuits to recognize the activation of a normally open switches (tamper, low air, temperature, etc.) Each zone is equipped with individual alarm (yellow) and trouble (yellow) LED’s for diagnostic ease. This card plugs into the second edge connector slot of the Main Board (MB-91A) and/or any Expander Board module (EB-91A/M) slot.

Important: *jumper settings must be positioned as noted.*

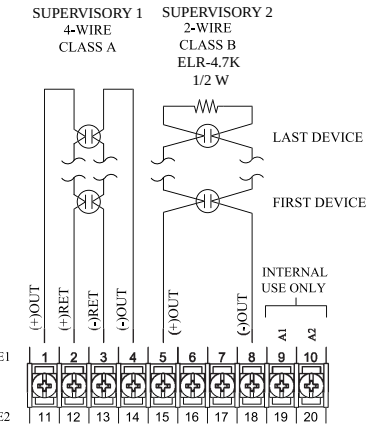
OPERATION:
Supervisory Alarm - A shorted supervisory device will initiate a supervisory alarm mode of operation. The on-card “ALARM” (yellow) indicator will light steady and the “SYSTEM TROUBLE/SUP” (yellow) indicator on the Control Card CC-91A will light steady. The System trouble buzzer will sound and the common supervisory and common trouble contacts on the MB-91A will transfer.
Trouble - An open in the detection loop will initiate the circuit into a trouble condition and activate the trouble buzzer located on the MB-91A. The respective zone “TROUBLE” (yellow) indicator as well as the “SYSTEM TROUBLE/SUP” indicator on the CC-91A will activate



SC-91A Display Panel

SC-91A Field Wiring

SUPERVISORY DETECTION



Terminations on expander board terminals TE1 or TE2

JUMPER SETTINGS:

MJ1 & 2	Placed jumpers across JP1 & 2 terminals 2 & 3 circuits are assigned for supervisory alarm condition.
MJ3 & 4	Jumpers are not installed
MJ5 thru 8	Jumpers must be installed across JP5 & JP6 MJ7 & MJ8 are not installed.
MJ9	Placed across JP9 terminals 2 & 3 to clear zone trouble indicators during an alarm condition. Placed across terminals 1 & 2 to maintain trouble indications during alarm condition.
MJ10 & 11	JP10 & JP11 must always be installed for circuits assigned for waterflow alarm

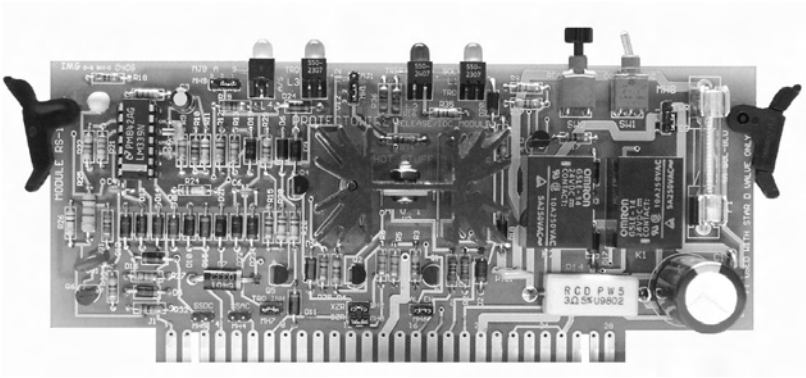
SC-91A Variations:

SC-91A	Switch Supervisory zone card: Provides (2) Class A/B switch supervisory detection circuits.
SC-91ANL	Switch Supervisory zone card: Provides (2) Class A/B non-latching switch supervisory detection circuits.
SI-91A	Intrinsic Switch Supervisory zone card: Provides (2) Intrinsic Class B switch supervisory detection circuits.

SC-91A Indicators - Switch Supervisory Card:

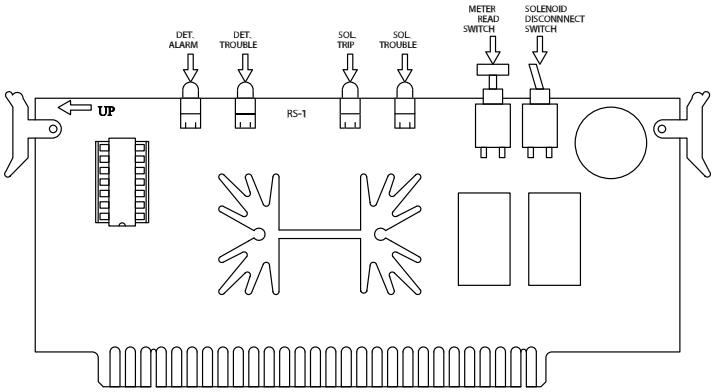
ALARM	Yellow-Alarm	Switch Supervisory Zone alarm indicator: Activates with respect to each Switch Supervisory zone in alarm.
TROUBLE	Yellow	Zone trouble indicator: Activates in respect to each zone in TROUBLE condition

Option “F” - Solenoid Release/Initiating device card, RS-1



Description: The RS-1 Solenoid release / initiating device card provides one supervised solenoid output circuit. This circuit electrically energizes the coil of a releasing agent control valve and is equipped with "Trouble" and "Trip" L.E.D. indicators for complete valve supervision and activation monitoring. An on-board auxiliary alarm (release) contact is supplied making remote signaling upon solenoid activation easily implemented. This card is also equipped with one Class B initiating device circuit that is jumper selectable for either alarm or supervisory field components. A meter read switch is provided to activate alarm point location on the circuit when used in systems employing the Protectowire Alarm Point Location Meter.

Release Circuit Activation Operation: Trip - When the releasing output circuit is triggered by the appropriate programmed zone/s, the solenoid coil is energized opening the control valve allowing the extinguishing agent to be expelled. The "Trip" indicator (red) will light showing that voltage has been supplied to the releasing circuit field terminals. Cross-zoned operation is achieved through the use of the ZV-91 (see option V) or by removing micro-jumper MJ3 and applying activation signals to the designated terminals of the Main Board MB-91A or Expander Board EB-91A.



Release Circuit Trouble Operation:

Short - If a short circuit (less than 2.5 Ohms) occurs across the solenoid output circuit the "SYS. TRO." L.E.D. (yellow) on the Control Card flashes, the system trouble buzzer pulses, and the solenoid card "Trouble" L.E.D (yellow) lights steady. Clear any short to restore to standby.

Open - If an open in the field wiring to the solenoid coil occurs (greater than 1500 Ohms) the "SYS. TRO." L.E.D. flashes, the trouble buzzer pulses, and the solenoid card "Trouble" L.E.D (yellow) lights steady. Clear the open to restore to standby.

Solenoid Disconnect: Prior to servicing the control panel the solenoid coil/s must be disconnected to prevent accidental release of extinguishing agents. Simply toggle the "SOL. DISC." Switch down to the "OUT" position. A Solenoid trouble condition will be indicated. Press "TRO. SIL." To silence the system. **THE BEST METHOD TO INSURE AGAINST ACCIDENTAL DISCHARGE IS TO REMOVE FIELD WIRES AND CUT OFF WATER SUPPLY. THE ABOVE DISCONNECT SWITCH SHOULD ONLY BE USED WHEN NO OTHER METHOD OF DISCONNECT IS FEASIBLE.**

Initiating device circuit operation: (Class B Only)

Alarm - A shorted detection or supervisory device will initiate the circuit to an alarm condition. Detection devices will cause the system to function in the fire alarm mode of operation. The on card zone "Alarm" indicator (red) will light steady; the "Sys. Alarm." indicator (red) on the Control Card CC-91A will light steady. The common alarm contacts on the MB-91A will transfer, and the common alarm Notification Appliance Circuits will operate. Any auxiliary panel functions designed to operate upon an alarm condition, will operate at this time.

Supervisory Alarm: - Supervisory devices will initiate supervisory alarm mode of operation. The on card zone "Alarm" indicator (yellow) will light steady; the "System. Trouble / Sup." indicator (yellow) on the Control Card CC-91A will light steady. The system trouble buzzer will sound steady and the common supervisory and common trouble contacts on the MB-91A will transfer.

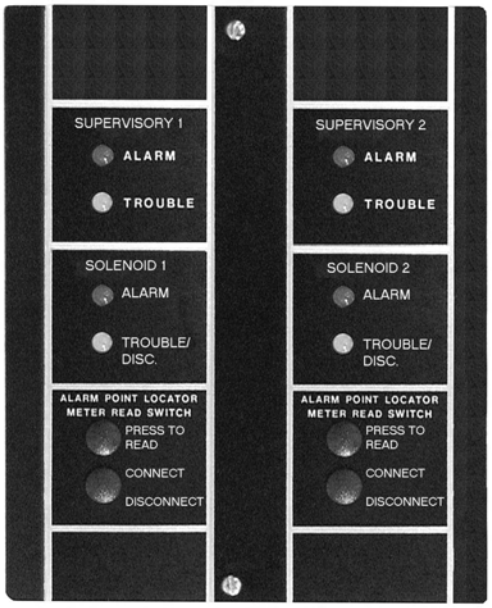
Trouble - An open in the Class B loop will initiate the circuit into a trouble condition. The on card zone "Trouble" indicator (yellow) will light steady; the "Sys. Tro." Indicator (yellow) on the CC-91A will flash; the system trouble buzzer will pulse.

Solenoid Release/Initiating Device Card
Field Wiring, Electrical Specifications & Jumper Settings

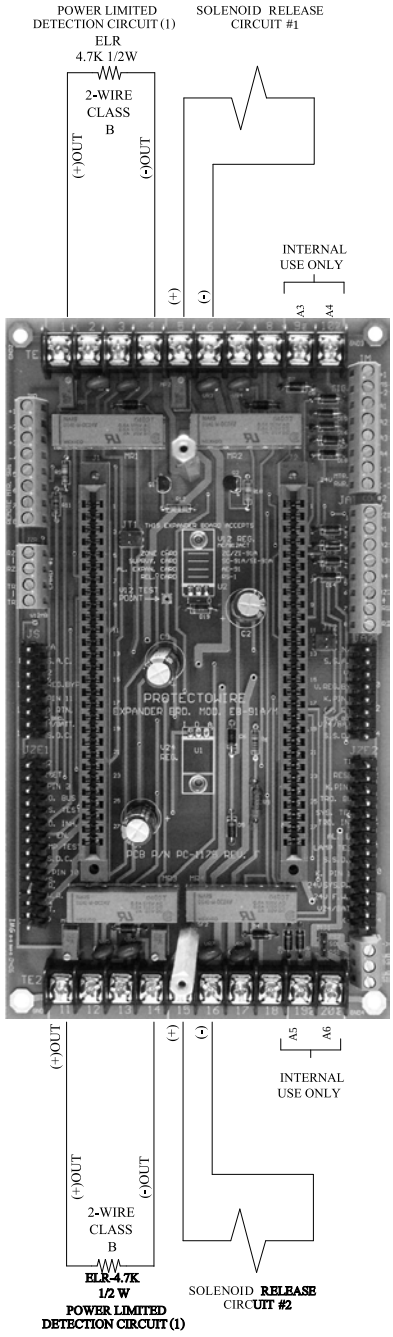
Electrical Requirements:

Electrical - Initiating Device Cirucit	
Voltage Standby	22VDC
Current to Insure Alarm	11mA
Less than 1.5K Ohm loop resistance maximum to insure alarm	
End-of-Line Resistor (detection zone)	ELR-4.7K 1/2 Watt, 5%

Electrical - Solenoid Release Circuit	
Voltage Standby	0.87VDC @ 1K Ohm
Voltage Alarm	26VDC
Current Alarm	0.7 AMp Nominal
Conditioning Resistor (solenoid)	1K ohm, 1 Watt, 5%

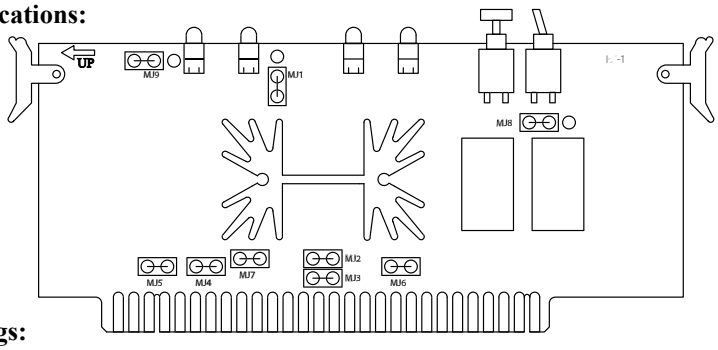


RS-1 Display Panel



Expander Board EB-91A/M

Jumper Locations:



Jumper Settings:

MJ1	Jumper is placed across header MH1 pins 1 & 2 to inhibit SOL & IDC indicators during system alarm state. Jumper is placed across pins 2 & 3 for active trouble indicators during system alarm state.
MJ2 or MJ3	Jumper is placed across MH2 header for signal input release activation for Solenoid Release circuit. For cross-zoned activation Jumper is installed across MH3.
MJ4 - MJ7	Remove jumpers across headers MH4 & MH5 and place jumpers across MH6 & MH7 for alarm zone operation. Place jumpers across MH4 & MH5 and remove jumpers across MH6 & MH7 for supervisory zone operation
MJ8	Jumper across MH8 pins 2 & 3 for all solenoid deluge valves other than the Star D module, which must have jumper placed across pins 1 & 2
MJ9	MH9 pins 1 & 2 installed when iniating device circuit is used as a detection zone. Place across pins 2 & 3 when used as a supervisory zone

Releasing Circuits -Solenoid Releasing Circuits are Power Limited

Maximum (2) conductor feed cable impedance

0.6 OHM= #10 AWG - 300 FEET
#12 AWG - 190 FEET
#14 AWG - 120 FEET

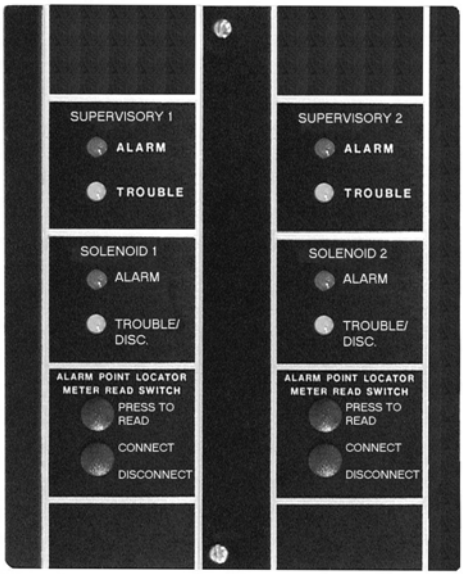
Applicable for UL Approved Systems Only

Solenoid Release/Initiating Device Card
Field Wiring, Electrical Specifications & Jumper Settings

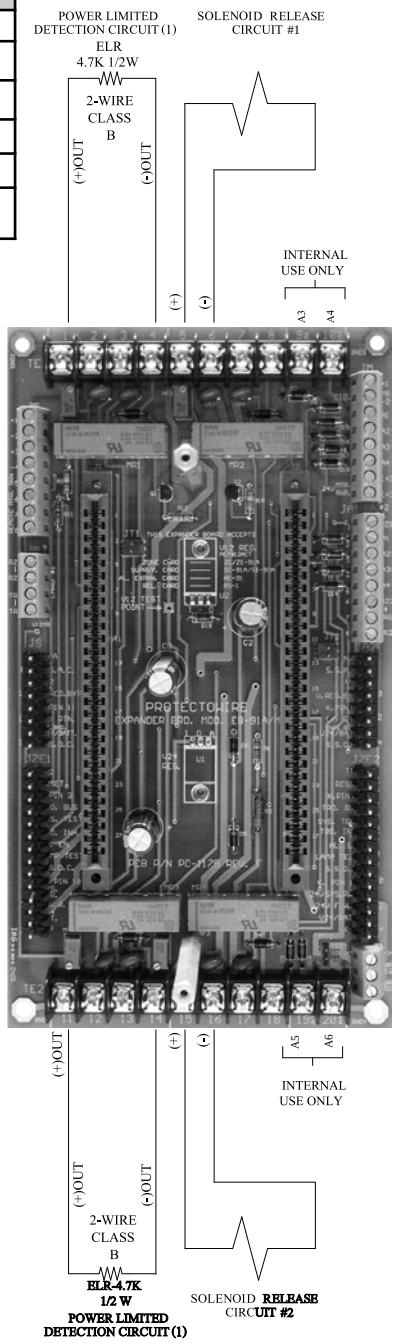
Electrical Requirements:

Electrical - Initiating Device Circuit	
Voltage Standby	22VDC
Current to Insure Alarm	11mA
Less than 1.5 K Ohm loop resistance maximum to insure alarm	
End-of-Line Resistor	ELR-4.7K, 1/2 Watt, 5%
FM approved Solenoid Groups	Groups A thru K
Fuse (F1) used with Star D (Group C valve only	4 Amp Slo-Blo

Electrical - Solenoid Release Circuit	
Voltage Standby	0.87VDC @ 1K Ohm
Voltage Alarm	26VDC
Current Alarm	0.7 AMp Nominal
Conditioning Resistor (solenoid)	1K ohm, 1 Watt, 5%

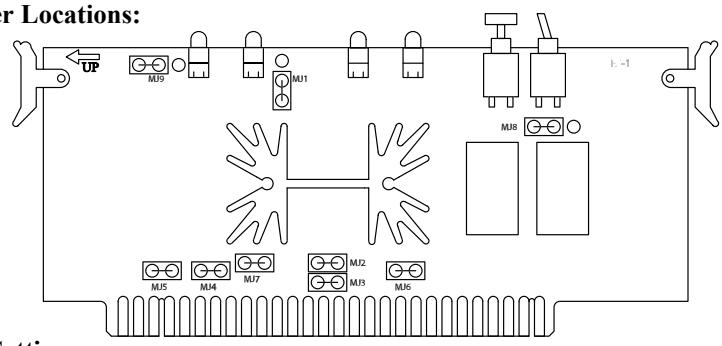


RS-1 Display Panel



Expander Board EB-91A/M

Jumper Locations:



Jumper Settings:

MJ1	Jumper is placed across header MH1 pins 1 & 2 to inhibit SOL & IDC indicators during system alarm state. Jumper is placed across pins 2 & 3 for active trouble indicators during system alarm state.
MJ2 or MJ3	Jumper is placed across MH2 header for signal input release activation for Solenoid Release circuit. For cross-zoned activation Jumper is installed across MH3.
MJ4 - MJ7	Remove jumpers across headers MH4 & MH5 and place jumpers across MH6 & MH7 for alarm zone operation. Place jumpers across MH4 & MH5 and remove jumpers across MH6 & MH7 for supervisory zone operation
MJ8	Jumper across MH8 pins 2 & 3 for all solenoid deluge valves other than the Star D module, which must have jumper placed across pins 1 & 2
MJ9	MH9 pins 1 & 2 installed when iniating device circuit is used as a detection zone Place across pins 2 & 3 when used as a supervisory zone

Releasing Circuits -Solenoid Releasing Circuits are Power Limited unless Star "D" (Group C) valves are used. Then circuits are considered non-power limited.

Maximum (2) conductor feed cable impedance

0.6 OHM= #10 AWG - 300 FEET
#12 AWG - 190 FEET
#14 AWG - 120 FEET

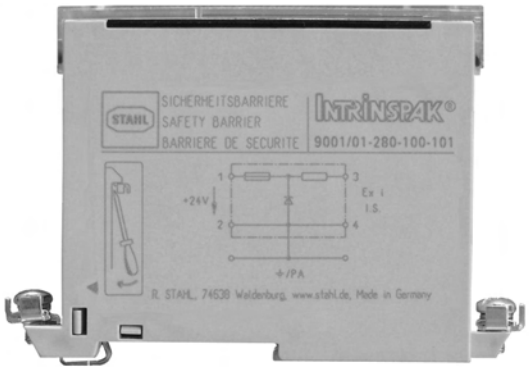
Applicable for FM Approved Systems Only

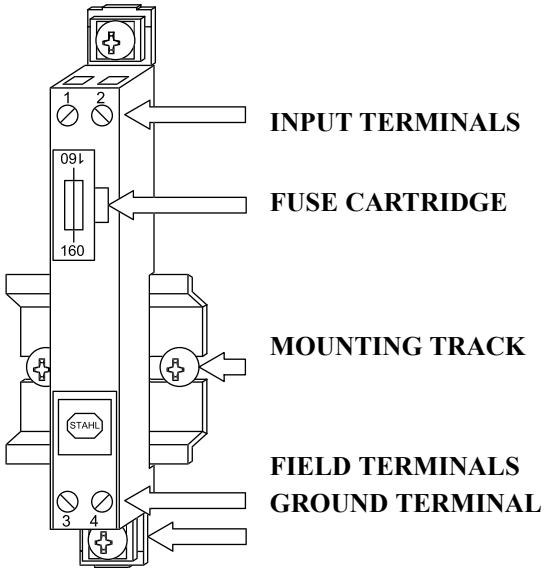
Option “H” - Intrinsic Safety Barrier for Special Hazard Applications

DESCRIPTION:
Some applications of PROTECTOWIRE linear heat detection circuits require energy limiting to prevent explosions in areas classified as hazardous locations. One method used to accomplish this “Intrinsic Safety” is to utilize diode shunt barriers. Diode shunt barriers consist of zener diodes with current limiting resistors which “shunt” excess voltage spikes to ground.

OPERATION:
The Stahl # 9001/01-280-100-101 is a single channel barrier used in the FS2000 Series Fire Alarm Control Panels to provide protection in hazardous locations. If excess voltage appears across the detection circuit, the internal zener diodes of the barriers instantaneously conduct in the reverse bias direction passing the overflow current directly to earth ground. The replaceable 160mA fuse protects the barrier from reverse polarity connection or from exposure to damaging current levels.

Intrinsic Safety Barrier
Stahl 9001/01-280-100-101

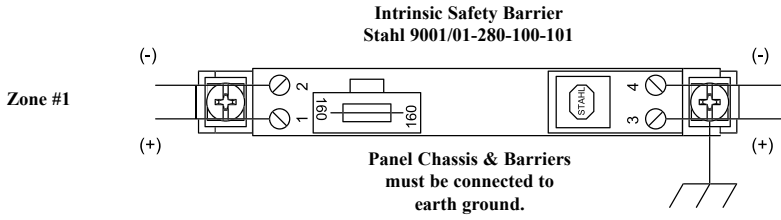


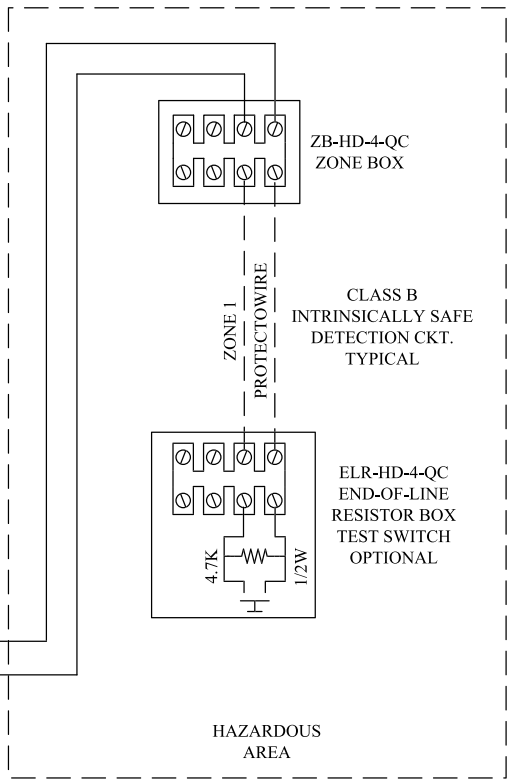


ELECTRICAL	
Nominal Input Voltage	24VDC
Maximum Input Voltage	28VDC
Internal Resistance	303 ohms +/- 16 ohms
Fuse Rating	160mA rep.#011239
Leakage Current	less than 1uA

SPECIAL NOTES:

1. Resistance from barrier mounting strip to earth ground **must be** 1 ohm or less.
2. ALL intrinsically safe wiring **must be isolated from non-safe wiring and routed in a separate conduit.**
3. **Non-safe** wiring **must not** cross into safe wiring area segregated by black lines within the system enclosure.
4. The system ground fault detection circuit is disabled due to the negative leg of the initiating circuit being connected to earth ground.
5. **WARNING: The negative of initiating circuit is connected to earth ground, therefore a ground fault from the positive leg of the initiating circuit will result in a false alarm.**
6. Suitable for hazardous locations Class I, II and III, Division 1, Groups A through G.
7. Reference control drawing IL-1008 for installation.
8. The FS2000 Control Panel and associated intrinsic safety barriers **must** be installed and located outside of the hazardous area.





OPTION FACTORY MUTUAL APPROVED ONLY

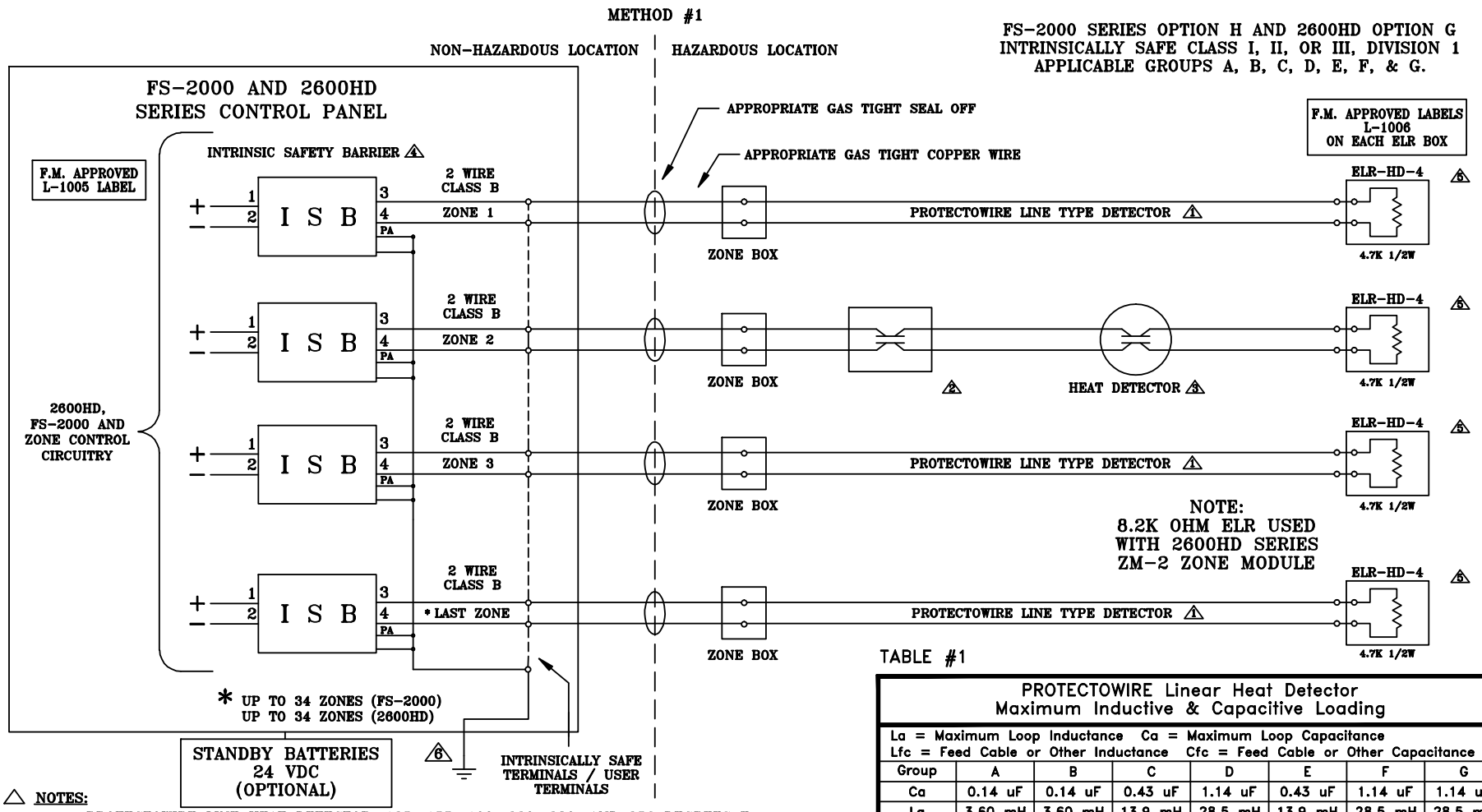


TABLE #1

PROTECTOWIRE Linear Heat Detector
Maximum Inductive & Capacitive Loading

La = Maximum Loop Inductance Ca = Maximum Loop Capacitance
Lfc = Feed Cable or Other Inductance Cfc = Feed Cable or Other Capacitance

Group	A	B	C	D	E	F	G
Ca	0.14 uF	0.14 uF	0.43 uF	1.14 uF	0.43 uF	1.14 uF	1.14 uF
La	3.60 mH	3.60 mH	13.9 mH	28.5 mH	13.9 mH	28.5 mH	28.5 mH

La ≥ ((2.5 uH / ft.) x (PROTECTOWIRE ft.)) + (Lfc)
Ca ≥ ((30 pF / ft.) x (PROTECTOWIRE ft.)) + (Cfc)

△ NOTES:

1. PROTECTOWIRE LINE HEAT DETECTOR, 135, 155, 190, 220, 280, AND 356 DEGREES F TYPE EPC, TYPE EPN, TYPE EPR, TYPE XLT, AND TYPE XCR.
   MAX. LENGTH PER ZONE FOR FS-2000 OR 2600HD SERIES = 5000 FEET (1524 METERS) OR AS CALCULATED PER APPLICABLE GROUP BY TABLE #1, WHICH EVER IS LESS.
2. MANUAL STATION, PART NO. SG-32 SERIES (BY PROTECTOWIRE).
3. HEAT DETECTOR, SERIES 500-MODEL 501, 502, 503, 504, (BY CHEMTRON).
   SERIES 400-MODEL A, B, AT, A-B = TEMP. RATING 135 , 155 , 175 , 200 , 212 , (BY CHEMTRON).
   HEAT DETECTORS ARE SIMPLE APPARATUS AND DO NOT GENERATE MORE THAN 1.2V, 0.1AMP, 25uW OR 20uJ
4. INTRINSIC SAFETY BARRIER (ISB) PART NO. 9001/01-280-100-101, R. STAHL INC.
5. END OF LINE RESISTOR, PART NO. ELR-HD-1, ELR-HD-1A OR ELR-HD-4
6. RESISTANCE FROM ISB GROUNDSTRAP TO EARTH GROUND MUST BE ONE OHM OR LESS. COPPER WIRE, #12 AWG MIN.
7. EQUIPMENT SHALL NOT USE OR GENERATE GREATER THAN 250V.
8. WIRING MUST FOLLOW NATIONAL ELECTRICAL CODE & ANSI/ISA RP12.6 (WIRE ACCORDINGLY)

PROTECTOWIRE FireSystems
Manufacturer of Special Hazard Fire Detection Systems

METHOD 1 TYPICAL FIRE DETECTION CIRCUIT WITH STAHL BARRIERS

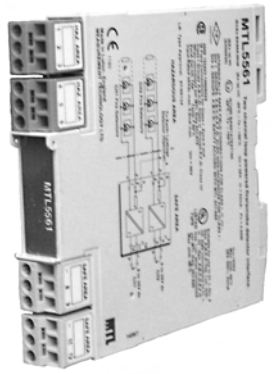
DATE	REVISION	DWN:	CHKD:	APPD:
2/2000	ADDED 2600HD SERIES	DATE: 7/27/89	SCALE: NTS	TOL:
6/2004	ISB FROM -10 TO -101	THE PROTECTOWIRE CO., INC. Hanover, Massachusetts	DWG NO: IL-1008P	
5/2011	UPDATE PROTECTOWIRE TYPES			

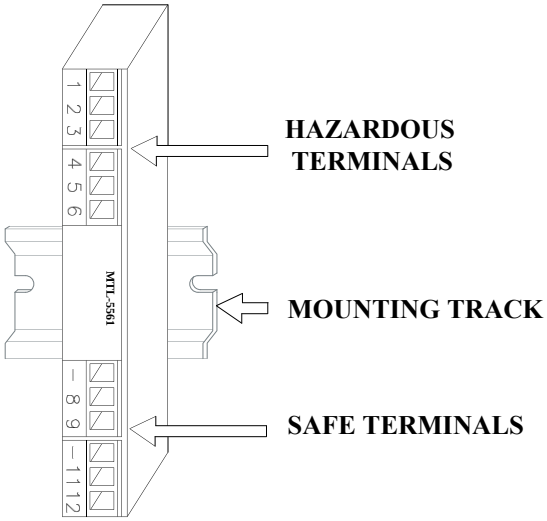
Option “K” - Intrinsic Safety DC Isolator for Special Hazard Applications

DESCRIPTION:
In some hazardous area applications, the loss of ground fault detection in non-safe field circuits is unacceptable. Such cases require the implementation of DC isolators. These devices provide three part isolation between the initiating circuit input, output and power supply circuits of each unit. Also intrinsic safety is provided without the need for special earth grounding which reduces the cost in most installations.

OPERATION:
Intrinsic Safety is accomplished through DC isolation provided by a small ferrite current limited transformer and demodulators. With this segregation spikes and other circuit abnormalities that occur in the non-safe (primary side) areas are eliminated due to the transformer isolation from the safe (secondary side) area circuit. When the secondary loop is shorted by a Protectowire activation, the primary attempts to compensate for the additional current drain of the secondary by drawing more current from the initiating circuit activating it into an alarm. If the secondary is opened through a wiring fault, the primary compensates by decreasing the current drain on the initiating circuit resulting in a trouble indication.

MTL-5561 DC ISOLATOR - TWO CHANNEL INTRINSIC SAFETY BARRIER*
***(REFERENCE IL-1008-2 FOR MAXIMUM PROTECTOWIRE LENGTHS)**



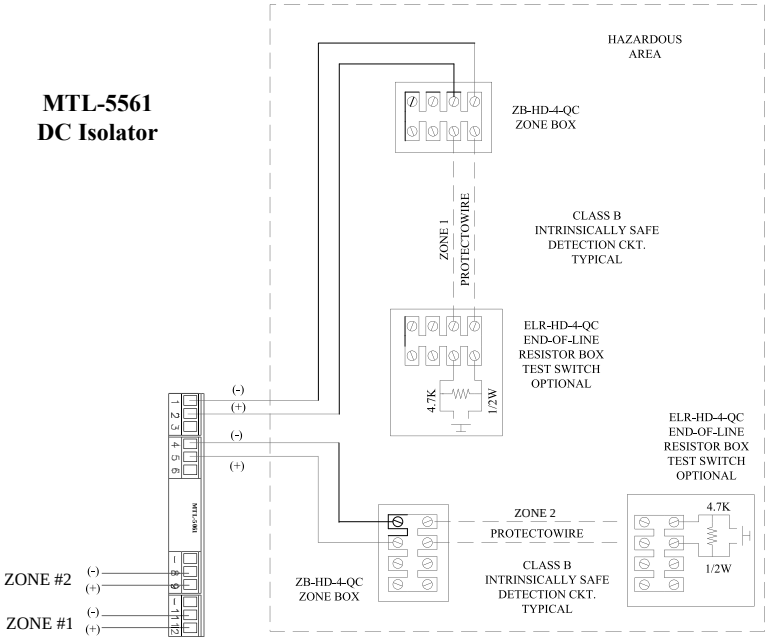


ELECTRICAL	
Nominal Input Voltage	24VDC
Current to insure alarm	12.5 mA
Short Circuit current	35 mA
Supervisory current	4.5 mA
End-of-line resistor	ELR-4.7K, 1/2W (Class B only)

SPECIAL NOTES:

1. ALL intrinsically safe wiring **must be isolated from non-safe wiring and routed in a separate conduit.**
2. **Non-Safe** wiring **must not** cross into safe wiring area segregated by black lines within the system enclosure.
3. A ground fault to the hazardous area side of the DC isolator(s) **will not be** detected. All other circuit ground faults will be detected.
4. Suitable for hazardous locations Class I, II and III, Division 1, Groups A through G.
5. Not compatible with Option “A” Alarm point location meter.
6. Reference control drawing IL-1008-2 for installation.
7. The FS2000 control panel and associated intrinsic safety barriers **must** be installed and located outside of the hazardous area.

MTL-5561
DC Isolator



OPTION FACTORY MUTUAL APPROVED ONLY

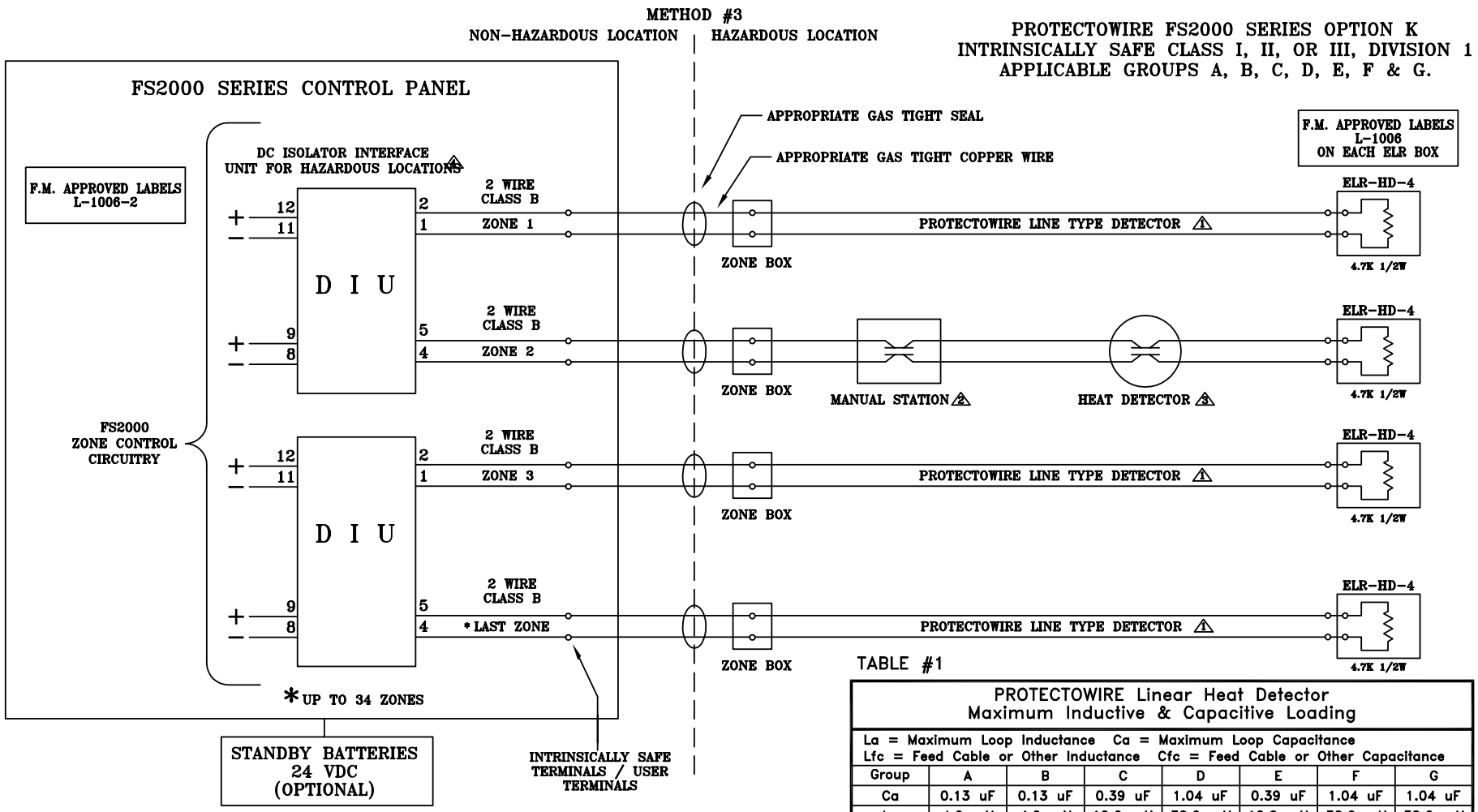


TABLE #1

PROTECTOWIRE Linear Heat Detector
Maximum Inductive & Capacitive Loading

La = Maximum Loop Inductance Ca = Maximum Loop Capacitance
Lfc = Feed Cable or Other Inductance Cfc = Feed Cable or Other Capacitance

Group	A	B	C	D	E	F	G
Ca	0.13 uF	0.13 uF	0.39 uF	1.04 uF	0.39 uF	1.04 uF	1.04 uF
La	4.0 mH	4.0 mH	12.0 mH	32.0 mH	12.0 mH	32.0 mH	32.0 mH

La ≥ ((2.5 uH/ft.) x (PROTECTOWIRE ft.)) + (Lfc)
Ca ≥ ((30 pF/ft.) x (PROTECTOWIRE ft.)) + (Cfc)

△ NOTES:

1. PROTECTOWIRE LINE HEAT DETECTOR, 135, 155, 190, 220, 280, AND 356 DEGREES F, TYPE EPC, TYPE EPN, TYPE EPR, TYPE XLT, AND TYPE XCR.
   PART NO. PHSC. MAX LENGTH PER ZONE = 5000 FEET (1524 METERS)
   *OR AS CALCULATED PER APPLICABLE GROUP BY TABLE #1, WHICH EVER IS LESS.
2. MANUAL STATION, PART NO. SG-32 SERIES (BY PROTECTOWIRE).
3. HEAT DETECTOR, SERIES 500-MODEL 501, 502, 503, 504, (BY CHEMTRON).
   302 SERIES TEMP. RATING 135.
   194 (BY THERMOTECH).
   HEAT DETECTORS ARE SIMPLE APPARATUS AND DO NOT GENERATE MORE THAN 1.2V, 0.1AMP, 25uW OR 20uJ
4. DC ISOLATOR INTERFACE UNIT (DIU) PART NO. MTL-5561, MTL INCORPORATED
5. END OF LINE RESISTOR, PART NO. ELR-HD-4
6. EQUIPMENT SHALL NOT USE OR GENERATE GREATER THAN 250V.
7. WIRING MUST FOLLOW NATIONAL ELECTRICAL CODE & ANSI/ISA RP12.6 (WIRE ACCORDINGLY)

PROTECTOWIRE
Special Hazard Fire Alarm Systems

METHOD 3 TYPICAL FIRE DETECTION CIRCUIT WITH DC ISOLATORS

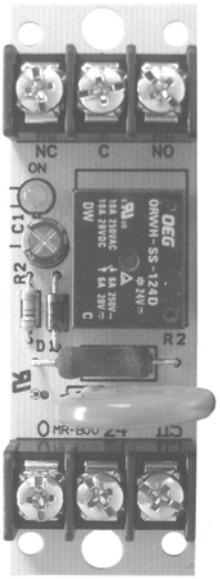
DATE	REVISION	DWN: BJH	CHKD:	APPD:
4/2011	MTL-5561 FROM 5061	DATE: 5/7/91	SCALE: NTS	TOL:
10/05	MTL-5061 FROM 3043	THE PROTECTOWIRE CO., INC. Hanover, Massachusetts	DWG NO: IL1008-2G	
03/06	2.5 uH WAS 7.0uH			

Option “L” AND “LL” - Auxiliary Zone Alarm Relays

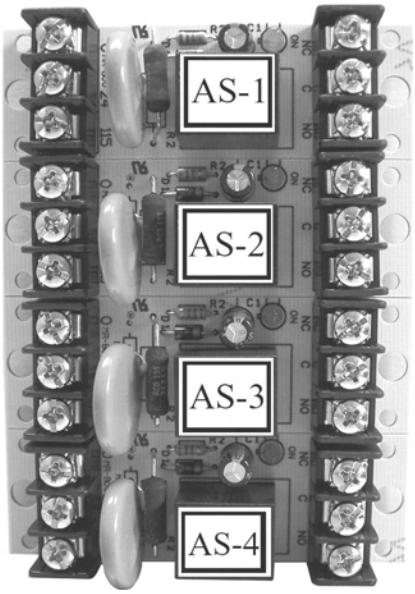
DESCRIPTION:
Auxiliary zone alarm signaling relays (AS) are often needed to provide an interface to other systems for annunciation and/or to pilot electrical shutdown. Also, (AS) relays may be used for cross zoning initiating circuits or various panel control functions. Reference the Installation Wiring Diagram (IWD) for specific function of installed relays.

OPERATION:
These relays are typically de-energized and sourced with 24V full wave rectified (FWR) power to the positive side of the coil. The coil negative is connected to a zone output terminal. Each zone output terminal is internally connected to an open collector transistor switch to system common. When the appropriate zone goes into an alarm state this “negative going” output activates the relay and its contacts change state.

OPTION L - 1 RELAY



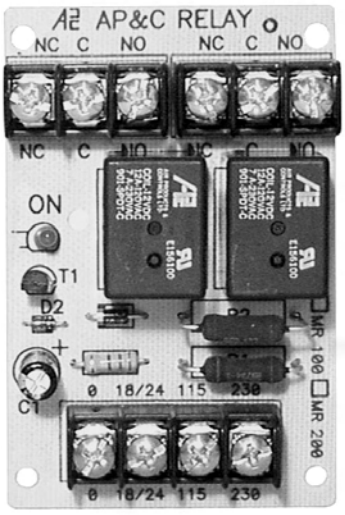
OPTION L4 - 4 RELAYS



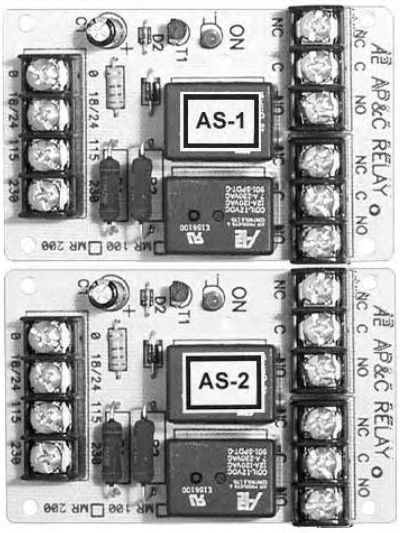
ELECTRICAL- OPTION “L”

DC Contact Rating	10 Amps @ 24VDC
AC Contact Rating	10 Amps @ 115VAC
Contact Configuration	SPDT
Coil Rating	0.015 Amps @ 24VDC
Indicator	Red LED

OPTION LL - 1 RELAY



OPTION LL2 - 2 RELAYS



ELECTRICAL- OPTION “LL”

DC Contact Rating	10 Amps @ 24VDC
AC Contact Rating	10 Amps @ 115VAC
Contact Configuration	DPDT
Coil Rating	0.035 Amps @ 24VDC
Indicator	Red LED

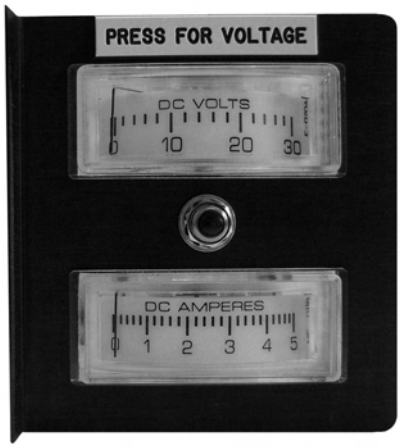
Option “P” - Battery Charger Status Meters

DESCRIPTION:
An available numerical indication of battery status may be provided with Battery Charger Status Meters. These meters supply an easy-to-read accurate display of both the charger current draw and the charging/standby voltage level.

OPERATION:
The ammeter continuously displays battery charger current draw. This level may be between 1.250 amps and 0.012 amps (trickle current), depending on the present charge state of the batteries. The voltmeter **does not** continually monitor the charger voltage level. Depress the Voltmeter Read Switch to read the voltage level of the batteries. While in standby “AC. ON” mode, the voltage level reflects the battery set and charger levels in a charging state. While in “AC. OUT” mode, the voltage level reflects the actual standby battery set voltage level.

ELECTRICAL:

Voltmeter	Range 0-30 VDC +/- 5%
Ammeter	Range 0-5.0 amps +/- 5%



DC Voltmeter

Voltmeter Read Switch

DC Ammeter

Option “Q” - Time Delay Relay

DESCRIPTION:
A time delay relay is employed to prolong the activation of a desired control function within the FS2000 Control Panel. This delay to operate a device provides an adjustable timing (fixed also available) cycle for field trimming ease.

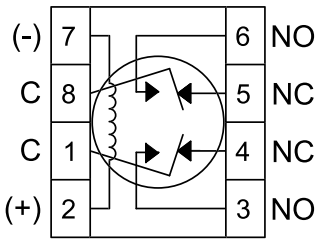
OPERATION:
Normally the time delay relay positive leg is sourced with 24VDC and the negative leg is connected to a low going zone output. Once the appropriate output is activated, the relay coil is energized and the timer cycle begins. After this cycle times out (completes), the relay contacts change state and activate the desired control function. This device is usually self resetting once the output activating it is reset or cleared. Rotate the timer adjustment knob to adjust the timing cycle or duration to the desired setting.

Please reference the Installation Wiring Diagram for specific wiring and activation schemes.

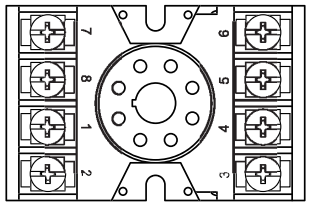
ELECTRICAL

Contact Rating	10 Amp @ 120VAC Resistive
Coil	24 VDC @ 0.125 Amp
Time Delay	0.6 - 60 Seconds
Other Time Delays are also available on special order	

CONTACT SCHEMATIC



RELAY SOCKET



Timer Adjustment

Option “R” - Common Alarm Signaling Relay

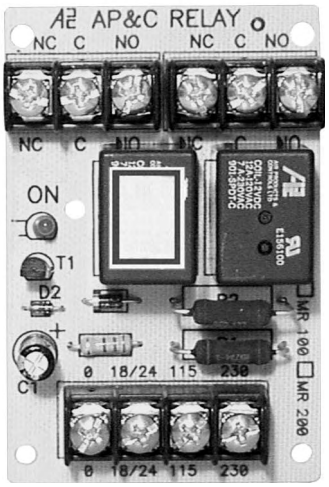
DESCRIPTION:
The Common Alarm Signaling (CAS) Relay provides two sets of contacts for interfacing to other control equipment upon the initiation of any alarm condition. This relay is normally non-silenceable but can be field modified to provide silenceable contacts.

OPERATION:
The relays positive terminal (18/24) is sourced with 24V FWR. Once any detection zone is initiated (Alarm State), a “Common Alarm” negative going output connected to the negative (0) terminal of the relay is activated. The relay is then energized and the contacts change state. The relay resets when all initiating device zones are reset to the standby condition.

ELECTRICAL

DC Contact Rating	7 amps @ 24VDC
AC Contact Rating	10 amps @ 115VAC
Contact Configuration	DPDT
Coil Rating	0.035 amps @ 24VDC
Indicator	Red LED

Indicator (Red)



Option “S” - Common Trouble Signaling Relay

DESCRIPTION:
The Common Trouble Signaling (CTS) Relay provides two sets of contacts for interfacing to other control equipment upon any system trouble or switch supervisory alarm condition. This relay is normally non-silenceable but is field selectable by placing the jumper “B2” located on the Control Card to the “S” (Silenceable) position. See illustration below.

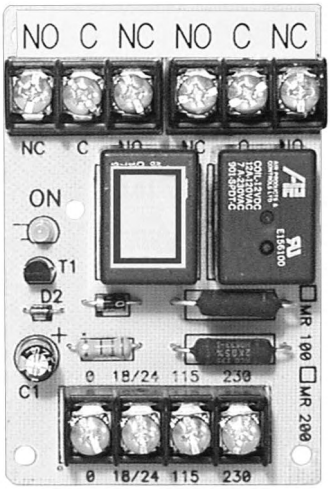
OPERATION:
When a system fault or supervisory occurs, the Main Board common trouble contacts, used as a pilot, change state de-energizing the (CTS) relay. The Common Trouble Signaling (CTS) Relay contacts in turn change state until the trouble condition is cleared or reset. If the control cards “B2” jumper is set at the “S” (Silenceable) position, the relay may be returned to the normal state by depressing the trouble silence button “Sys./TRO. SIL.” on the control card. Only in this mode will subsequent supervisory alarms cause the (CTS) relay to reactivate, otherwise the relay will remain de-energized until all system troubles are cleared or reset.

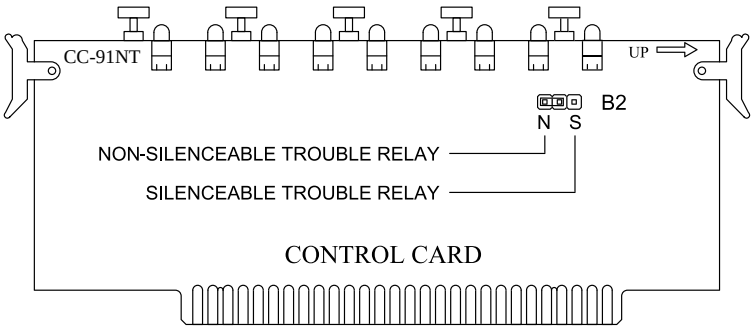
ELECTRICAL

DC Contact Rating	7 amps @ 24VDC
AC Contact Rating	10 amps @ 115VAC
Contact Configuration	DPDT
Coil Rating	0.035 amps @ 24VDC
Indicator	Green LED

See Note A

Indicator (Green)





Note A: A label has been added to reconfigure the contact arrangement of the CTS relay. This is necessary since the relay is normally energized and de-energizes in a trouble condition.

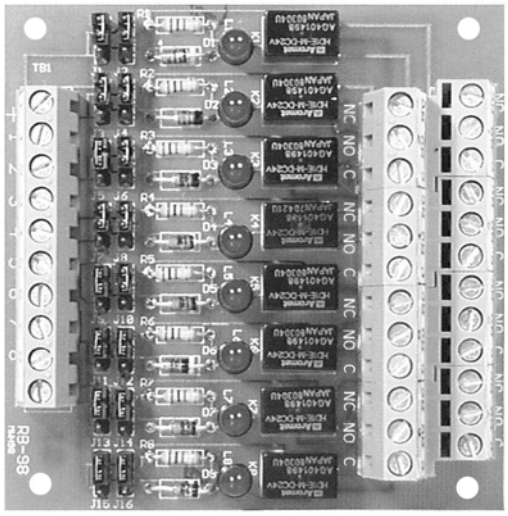
Option “RR” - Auxiliary Relay Module - RB-98

DESCRIPTION:
Auxiliary signaling relays are often needed to provide an interface to other systems for annunciation and/or to pilot electrical shut-down. Auxiliary signaling relays may be used for “cross zoning” initiating circuits or other various panel control functions. The RB-98 Relay Module provides (8) individually activated sets of Form “C” contacts in one module. Reference the Installation Wiring Diagram (IWD) for specific function of installed relays.

OPERATION:
The RB-98 relays are normally de-energized and sourced with 24V full wave rectified (FWR) power to the positive side of their coils, via the (+) terminal of TB1. The coil negatives are connected to input terminals TB1 1 - 8 . When the appropriate function occurs, its “negative going” output activates the relay and its corresponding contact set changes state. Indicators L1 through L8 (Red) illuminate when the corresponding input is received and the relay is activated. The RB-98 may also be configured to operate with 24V sourced inputs by connecting the negative (-) terminal TB1 to system common and placing jumpers J1 through 16 in the “DOWN” position. A 24 VDC “high going” output can then be wired to input terminals TB1 1 - 8 to activate each individual relay.

Option RR - RB-98
Jumpers J1 to J16 shown in (-) input “UP” position

INPUT TERMINALS

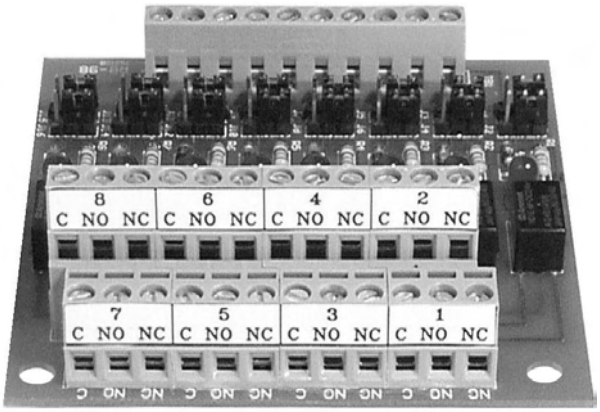


FORM “C” CONTACTS

JUMPERS J1-16

ELECTRICAL

DC Contact Rating	1 amp @ 24VDC
Contact Configuration (8)	SPDT
Coil rating each (8)	0.013 amps @ 24VDC
Terminal Wire Capacity	26-14 AWG solid / Braid
Indicator	Red LED



CONTACT TERMINALS

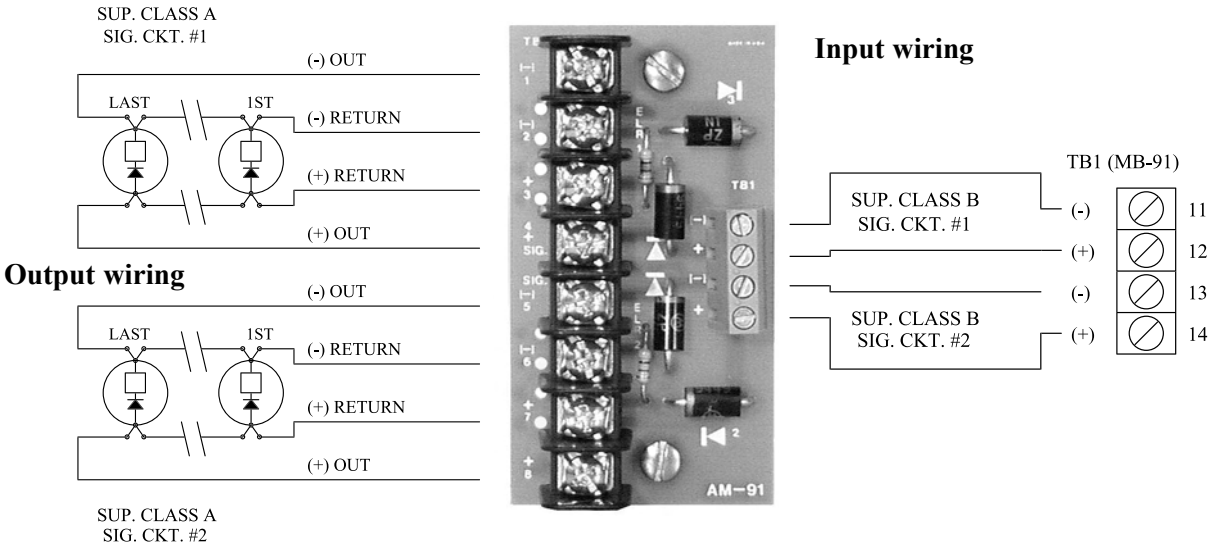
Option “T” - Class A Alarm Notification Appliance Circuit Adapter

DESCRIPTION:
The AM-91 Alarm Notification Appliance Circuit Adapter Module converts the two Class B system Alarm Notification Appliance Circuits of the Main Board MB-91 to Class A type circuits. This provides 4 wire alarm notification appliance circuits in lieu of the standard 2 wire circuits.

OPERATION:
The two wire Class B circuits are wired into the module input terminals. The AM-91 then conditions and converts the circuits to four wire Class A alarm notification appliance circuits. This alarm notification control appliance circuit is fully supervised with a reverse polarity current flow. A short or open in the field wiring is detected by the system controls. Once an alarm is initiated the circuit immediately reverses polarity and 24V FWR power is supplied to the alarm notification appliances. If a single break occurs in the circuit all devices will still be supplied power in an alarm state due to the nature of a Class A wiring configuration.

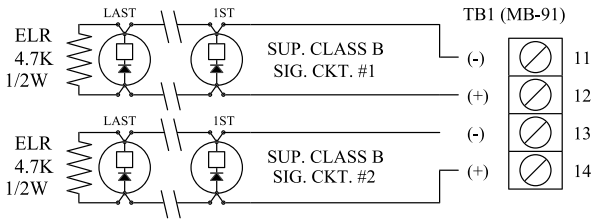
Voltage	24 V Full wave rectified (FWR) with battery standby
Current	2 amps per circuit 3 amps maximum combined
Maximum (2) conductor copper feed cable resistance may not exceed 1 ohm (see below)	
#10 AWG	Maximum of 500’ (feet) Reference DS-9066
#12 AWG	Maximum of 300’ (feet) Reference DS-9066
#14 AWG	Maximum of 200’ (feet) Reference DS-9066

AM-91 Class A Alarm Notification Appliance Circuit Adapter Module



Standard Class B Alarm Notification Appliance Circuits - For reference only

Note: Polarity of Notification Appliance Circuits shown in Standby Condition.

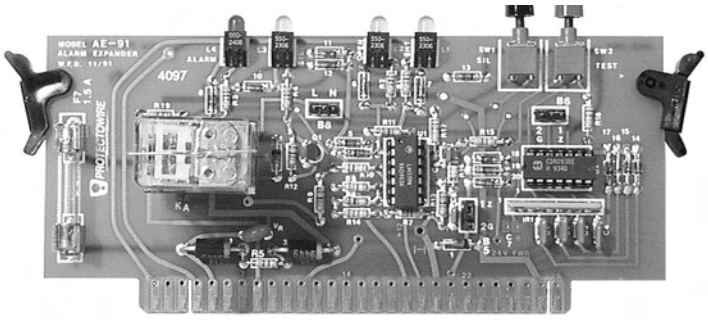


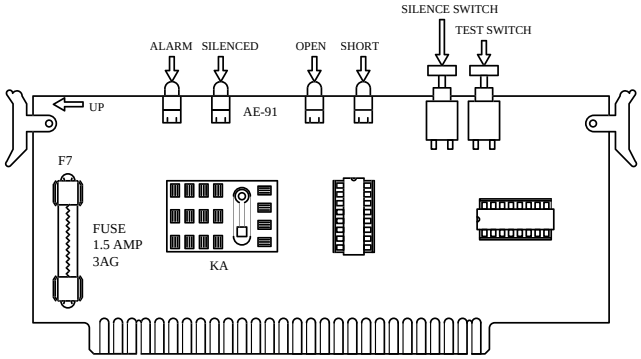
Option “U” - Alarm Expander Card

DESCRIPTION:
The AE-91 Alarm Expander Card provides one alarm notification appliance circuit which may be wired in a Class A or Class B configuration (NFPA styles X and Z or W and Y). The module plugs into an expander board (EB-91A) expansion slot and can be factory programmed for general alarm activation or for selective activation by up to (4) individual detection zones.

OPERATION:
A reverse polarity supervisory current monitors the field loop integrity reporting any short or open in the circuit to the control panel. When a fault condition occurs the respective LED (yellow) illuminates in conjunction with the system trouble LED and the system trouble buzzer pulses. Once an alarm input is received, general alarm or individual pre-programmed zones, the circuit polarity reverses and 24V FWR is supplied to the field output terminals. The Alarm LED illuminates indicating activation. By pressing the “Silence” button the alarm notification appliance circuit may be silenced. Once the circuit is silenced, pressing the system reset button “Sys. Rst.” will reset the circuit. If the circuit is not silenced, pressing the “Sys. Rst.” button will reset the control panel but the Alarm Expander will remain in an alarm state until its “Silence” button is pressed. When wired as a Class A circuit, all devices will be supplied power in the event of a single open condition in the field wiring. When wired as a Class B circuit, only the devices before the open condition will be supplied with power. Devices beyond the open condition **will not** operate. This module is equipped with an “Alarm Test” button that will simulate an alarm output being received by the module.

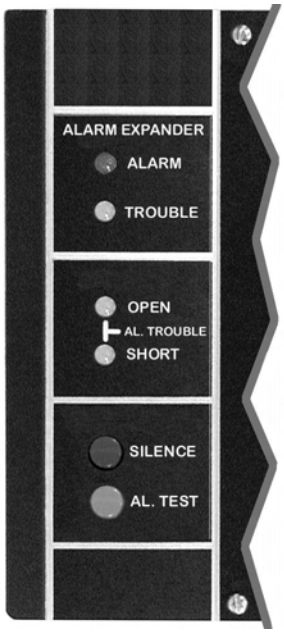
Alarm Expander Card (AE-91)

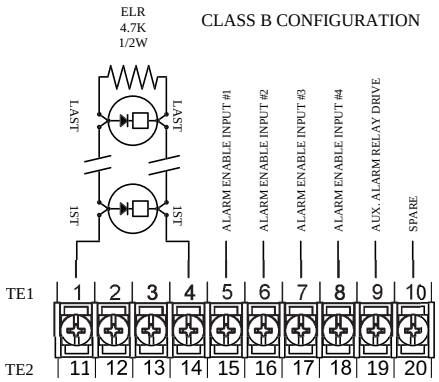


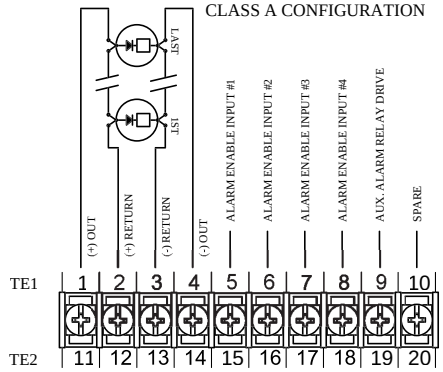


Alarm Voltage	24 V Full wave rectified (FWR)
Alarm Current	1 amp per circuit Maximum
Supervisory Current	0.002 amp maximum
Alarm Relay (KA)	P&B R10-E1-X4-V185
Fuse (F7)	1.5 amp (3 AG)
Maximum (2) conductor copper feed cable resistance may not exceed 1 ohm (Reference DS-9066)	
*Circuit current rating may be limited (reduced) depending on the power requirements of the system. Reference the Installation Wiring Diagram for the specific rating of each system	

AE-91
Display Panel







Expander Board
Field Terminals

Option “V” - Zone Voting Module

DESCRIPTION:
The ZV-91 Zone Voting Module is designed to supply an output signal upon the receipt of multiple zone alarm signals. The standard configuration produces a single output signal after receipt of (2) input signals. The module is also available in a (3) input version. The module can monitor up to sixteen inputs and provides (4) individual outputs for system function activation. This module provides versatility in system logic programming including cross zoning (see cross zoning applications data sheet).

OPERATION:
Upon receipt of either two or three (preset at factory) negative going signals on the input terminals, the corresponding output terminal is activated. The output is driven by a transistor switch to system negative. The illustration below depicts the most common configuration used in cross zoning applications. Four outputs are available, each output is controlled by (4) inputs. Normally only the first two inputs are utilized, (1) for an alarm zone output and the other for a low air supervisory alarm output.

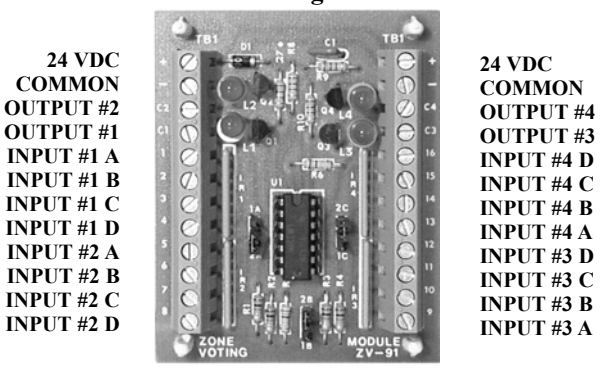
ELECTRICAL

Standby Power	24 VDC @ 5.5mA
Alarm Power	Range 0-1.0 Amp +/-5%
Output Rating	150mA maximum

INDICATORS

L1	Output #1 Activation Indicator
L2	Output #2 Activation Indicator
L3	Output #3 Activation Indicator
L4	Output #4 Activation Indicator

Zone Voting Module

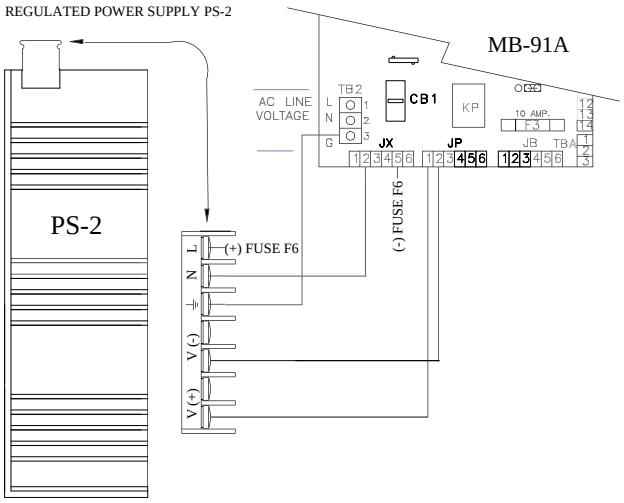


Option “W” - Auxiliary Power Supply

DESCRIPTION:
Option “W” increases the overall system power from 5.25 Amps to 9.0 Amps by utilizing an additional 24V regulated Power Supply. Typically this additional power is required for panel devices such as Release Modules (Option “F”), Alarm Expander Cards (Option “U”), etc. This regulated supply in conjunction with the MB-91A provides a completely supervised power source for systems with power requirements that exceed that of the standard system power supply. *Only one auxiliary power supply can be installed per system for Special Applications*.

OPERATION:
The regulated power supply is rated and distributed uniquely for each application. Reference the Installation Wiring Diagram (IWD) for each system to determine power distribution and availability. If the regulated power source is interrupted, the control panel will go into a trouble condition, the “SYSTEM TROUBLE/SUP” indicator will flash and the on board piezo buzzer will activate. AC power loss of either the standard or auxilliary supply will result in a full system transfer to batteries.

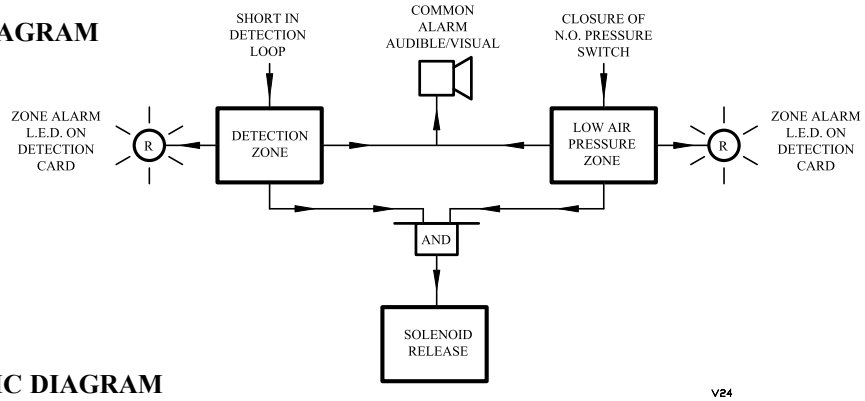
ELECTRICAL REQUIREMENTS	
Line Power	120VAC 50/60 Hz 1.7 Amps Max
DC Power	24 VDC 4.2 Amps Max
External Fuse	4 Amps 5x20mm
Reference IWD for power distribution	



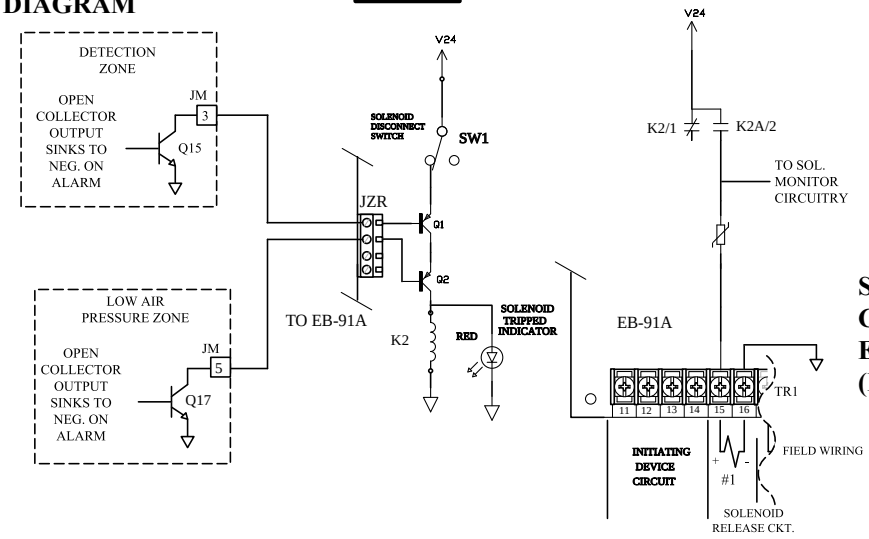
FS2000 Series Control Panel Preaction Double Interlock Deluge Cross Zoning Applications Data Sheet

Double Interlock Sprinkler Systems are designed to prevent accidental release of water. When the solenoid is energized, depressurization of the air filled pipes (loss of air) is required to obtain water at the sprinkler heads. This beneficial feature becomes a concern when the system is operating under battery backup power. Should depressurization (loss of air) not occur, the possibility of being energized and then de-energized due to battery drain, without allowing any waterflow exists. To prevent this situation CROSS ZONING of the zone detection circuit with a low air pressure alarm circuit is advised. The illustrations below provide logic and schematic diagrams for typical cross zoning applications utilizing the on-board cross-zoning capabilities of the RS-1. An alternate means of cross zoning can be achieved by implementing a zone voting module, Option "V". Please reference the Option "V" section of this manual for information pertaining to this module.

LOGIC DIAGRAM



SCHEMATIC DIAGRAM



SOLENOID RELEASE CARD (RS-1) WITH EXPANDER BOARD (EB-91A)

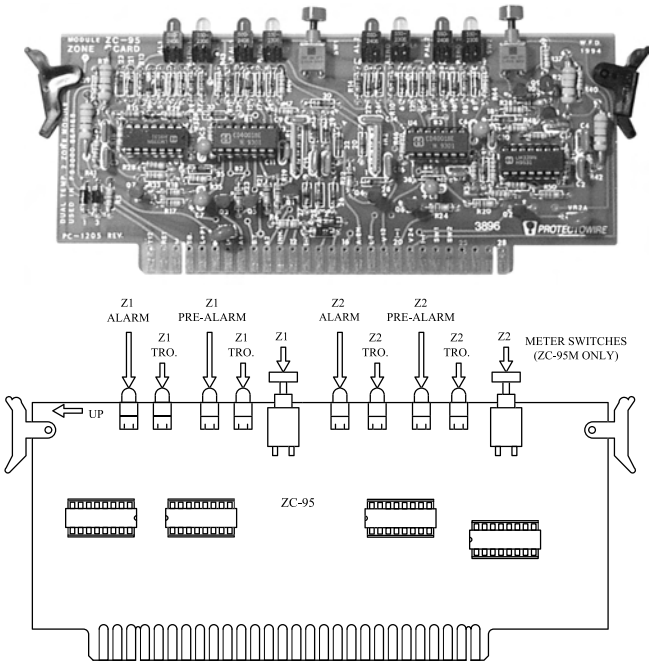
Note: Terminations shown may differ per system. Reference the system installation wiring diagram (IWD) supplied with each panel for specific wiring and terminations.

Upon receipt of an alarm indication from either the detection zone or low air pressure zone, the alarm notification appliance circuits are activated in conjunction with the zone alarm LED contained on the corresponding detection card. However, the solenoid [coil supervised and activated via RS-1 (Option "F") circuitry] is not energized until **both** circuits have been activated. Once both have been activated, the solenoid will be energized allowing water to be supplied to the sprinkler heads.

Reset the system by performing the following:

1. Notify the proper local fire department and/or alarm receiving station.
2. Press the system "AL. SIL." button to silence the alarm condition.
3. Disconnect any and all auxiliary alarm devices (solenoids, system shutdowns, etc.).
4. Clear/Reset all detection devices that are activated.
5. Reset sprinkler system (sprinkler heads, solenoids, re-pressurize sprinkler system with air).
6. Make sure pressure switches have been returned to a normally open (N.O.) state.
7. Press the system "SYS. RST." switch to clear zoned and common alarm conditions.
8. System should be in a trouble condition due to solenoid disconnection toggle switch, press the "TRO. SIL." button.
9. Return solenoid disconnect toggle switch to normal (UP) position and reconnect auxiliary alarm devices.
10. The panel should now be in a normal standby mode.

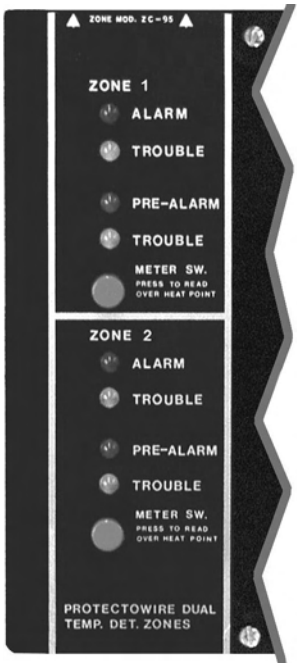
Option “X” - Dual Temp. Zone Card Module - ZC-95



ELECTRICAL/SPECIFICATIONS

Inherent Current	30 mA per card
Supervisory Voltage	21.5 VDC
Supervisory Current	4.5 mA per circuit
Maximum Alarm current	35 mA per circuit
Current to insure alarm	12 mA per circuit
Maximum loop resistance	1000 ohms per circuit
LHD per zone	5000 ft Max.
LHD = Linear Heat Detector	

ZC-95 DISPLAY PANEL



ZC-95 DESCRIPTION:

Provides two independent detection zones. Each zone is uniquely configured with two Class B initiating circuits along with signal processing circuitry. The ZC-95 is specifically designed for use with Protectowire’s 3-wire, Model TRI, dual temperature Linear Heat Detector. This card senses two alarm trip levels. The first is Pre-alarm (Low temp.) @ 155°F and the second is Alarm (High temp.) @ 200°F. In addition to a common alarm output signal, there is an auxiliary Pre-alarm output signal and an auxiliary Cross Temperature (similar to cross zoning) output signal provided by means of the on board logic circuit (Fig. 2).

Note: When employed with the Alarm Point Location Meter (Option “A”) the point of actuation for the Low Temp portion of the TRI wire detector is read only.

ZC-95 Variations

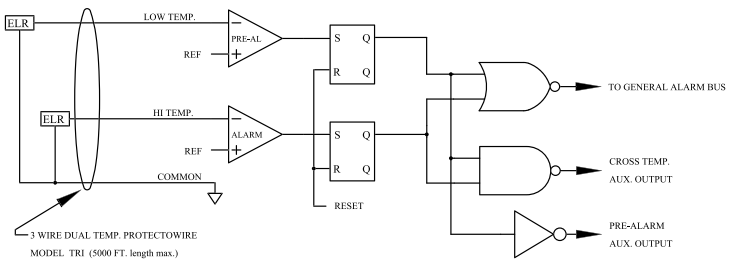
ZC-95	Dual Temperature Zone Card: Provides (2) “TRI” wire compatatible Class B detection zones.
ZC-95M	Metered Dual Temperature Zone Card: Provides (2) “TRI” wire compatible Class B detection zones also compatible with the Alarm Point Location Meter (Option “A”).

ZC-95 Control Switches

Meter SW. ZONE 1	Meter read switch Zone #1: Press and hold to read distance (ft/m) to alarm actuation point of Protectowire zone in alarm. See Option “A” - Protectowire Alarm Point Location Meter.
Meter SW. ZONE 2	Meter read switch Zone #2: Press and hold to read distance (ft/m) to alarm actuation point of Protectowire zone in alarm. See Option “A” - Protectowire Alarm Point Location Meter.

ZC-95 Indicators - Standard Type Zone Cards

ALARM	Red	Zone alarm indicator: Activates in respect to each high temperature zone in ALARM condition.
TROUBLE	Yellow	Zone trouble indicator: Activates in respect to each high temperature zone in TROUBLE condition.
PRE-ALARM	Red	Pre-Alarm zone indicator: Activates in respect to each low temperature zone in ALARM condition.
TROUBLE	Yellow	Pre-Alarm zone trouble indicator: Activates in respect to each low temperature zone in trouble condition.

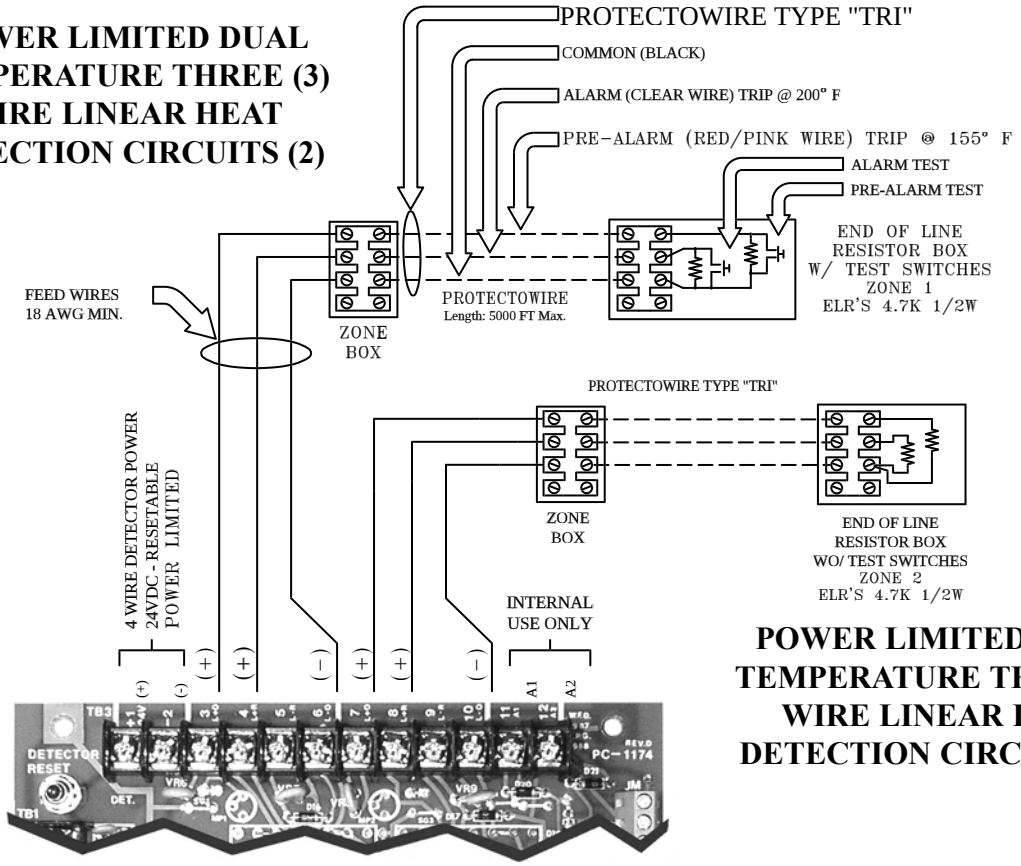


APPLICABLE FOR FM APPROVED SYSTEMS ONLY

Option “X” - Dual Temperature Zone Card - ZC-95

Field wiring for Main Board (MB-91) and Expander Board (EB-91)

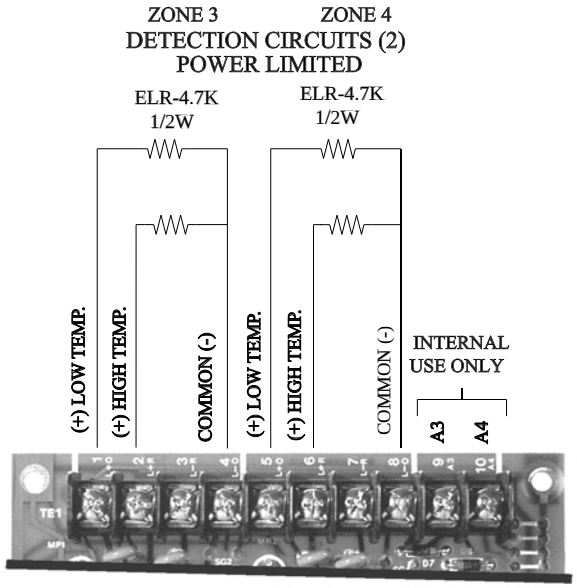
POWER LIMITED DUAL TEMPERATURE THREE (3) WIRE LINEAR HEAT DETECTION CIRCUITS (2)



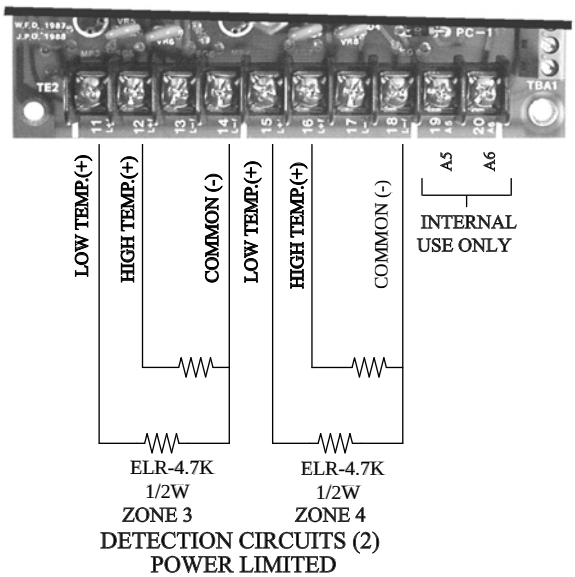
POWER LIMITED DUAL TEMPERATURE THREE (3) WIRE LINEAR HEAT DETECTION CIRCUITS (2)

MAIN BOARD TB3 TERMINAL

EXPANDER BOARD TE2 TERMINAL



EXPANDER BOARD TE1 TERMINAL



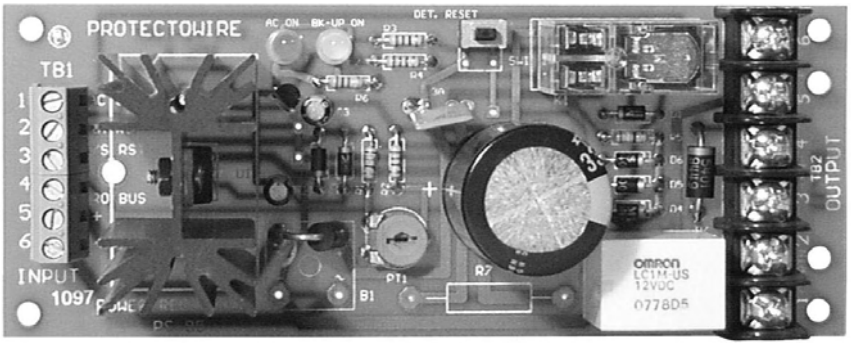
APPLICABLE FOR FM APPROVED SYSTEMS ONLY

Option “Y” - Power Conditioning Module

DESCRIPTION:
The PS-95 Power Conditioning Module is designed to provide filtered, regulated DC power from a full wave rectified source (FWR). The module can provide 26 VDC power to devices such as UV/IR detectors, Gas Detectors, Fiber Optic Controllers and Four Wire Smoke Detectors. This module also provides both resettable or non resettable outputs, either may be utilized depending on what the application requires.

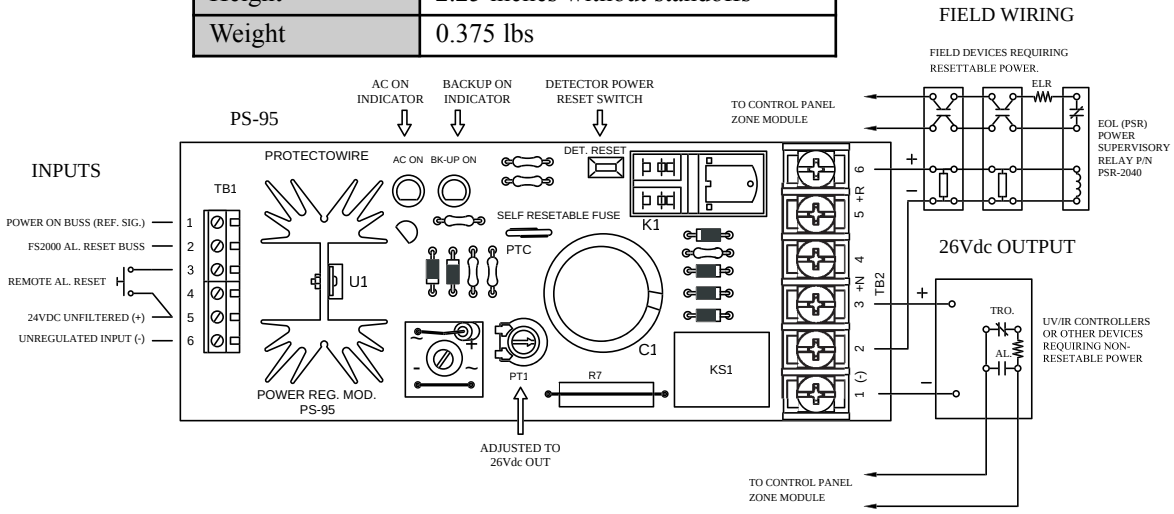
OPERATION:
26 Volt Non-regulated power (FWR) is fed into the PS-95 power input terminals from either the primary system power supply (MB-91) or an auxiliary power supply (PS-91 Option “W”). This power has an inherent battery backup which provides battery backup for the power conditioning module. The power conditioning module filters and regulates this power providing either resettable or non resettable field terminations. Resetting can be implemented in three ways: (1) the module may be wired into the system reset buss and will reset when the system reset switch is depressed, (2) the module has an on board reset switch which can be depressed to manually reset, or (3) a remote N.O. reset switch may be used (see wiring diagram below). When the module is regulating system power, the “A.C. ON” (Green) indicator is illuminated. When the module is on battery backup, the “BK-UP ON” (Yellow) indicator is illuminated. During battery backup, the modules regulation is bypassed and battery power is supplied directly to the output terminals. This avoids unnecessary voltage drops to devices powered by the module when on batteries. Since the PS-95 power is common to the system power, its output is monitored for ground faults by the systems built in ground fault detector. To implement power supervision to field devices supplied by the PS-95, a power supervisory relay (PSR-2040) must be used (see wiring diagram below and 4 wire detector power supervision page of this manual) unless the devices used have a means of supervising their own power source.

Power Conditioning Module - PS-95



SPECIFICATIONS

Continuous Output	26 VDC @ 1.5 Amps
Intermittent Output	26 VDC @ 2.0 Amps
Length	6.0 inches
Width	2.35 inches
Height	2.25 inches without standoffs
Weight	0.375 lbs



OPTION NOT UL LISTED OR FM APPROVED

Option "Z" - External Key Operated Switches

DESCRIPTION:

Option "Z" consists of four (4) externally mounted key operated switches. These switches are used to duplicate the main control functions normally operated by the push buttons mounted on the Control Card (CC-91) located inside the FS2000 system enclosure. System function provided by the external key switches are "System Reset," "Alarm Silence," "Trouble/Supervisory Silence" and "Lamp Test." All control switches are NEMA-4X rated and have been designed primarily for use in conjunction with the LTi Series, NEMA-4 rated Industrial Enclosures. **This option is not available for the LTi2X model enclosure.** Although intended primarily for industrial applications, Option "Z" is compatible with all standard EN Series, Type-1 Enclosures and may be utilized in these systems when external control of basic system functions is required.

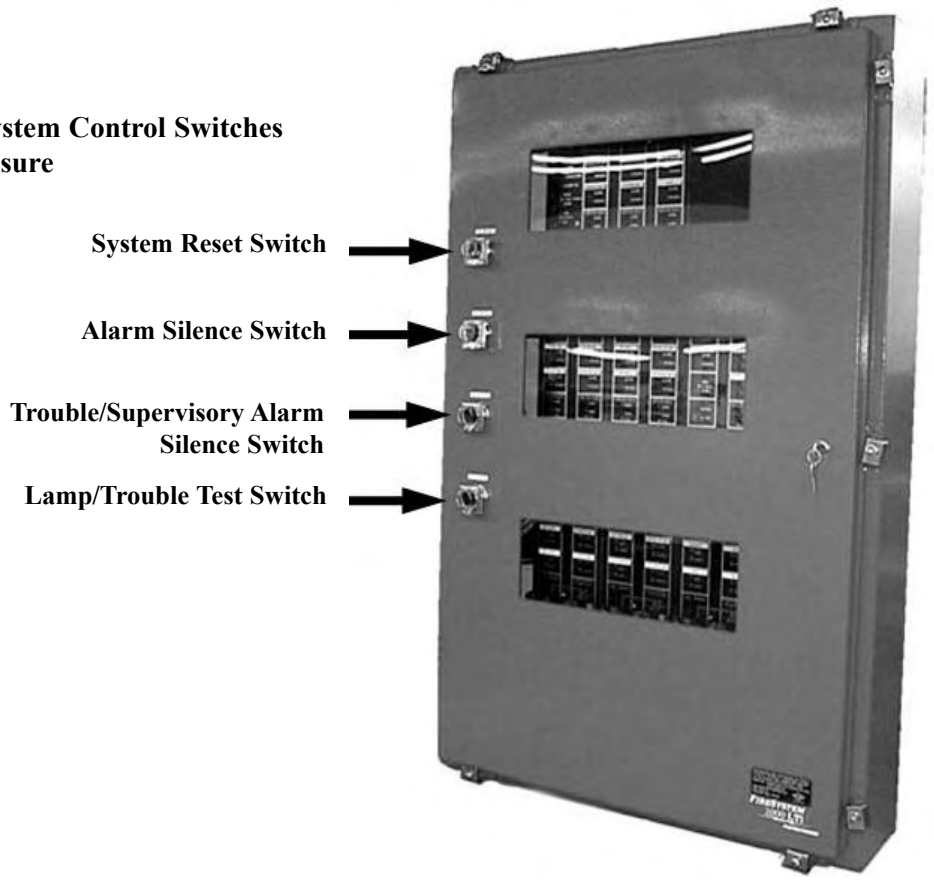
OPERATION:

Each switch is key operated. The same key will operate each switch. See the table below for each switches control function and operation.

External Key Operated System Control Switches

SYSTEM RESET	System Reset Switch. Insert key and turn clockwise to reset from ALARM condition
ALARM SILENCE	Alarm Silence Switch. Insert key and turn clockwise to silence notification appliances activated by ALARM condition.
TROUBLE/ SUPERVISORY SILENCE	Trouble/Supervisory Alarm Silence Switch. Insert key and turn clockwise to silence activated common trouble signal (pulsating buzzer) or supervisory alarm signal (steady buzzer)
LAMP/ TROUBLE TEST	Lamp test and Trouble test button. Insert key and turn clockwise to test indicator lamps and system trouble signaling.
Note: The function of the external switches duplicates that of the internal control switches described for the Main Board and Control Card. The control switch actions may be achieved using either the internal or external switches.	

External Key Operated System Control Switches Mounted in an LTi9 Enclosure

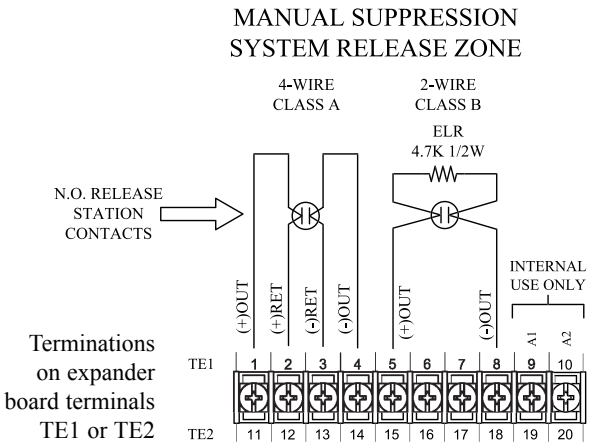


Preaction Manual Release Station

DESCRIPTION:
When solenoid releasing is employed, a means of manually activating the solenoid must also be provided for each release circuit as required by Underwriters Laboratories. The SG-32SK1 non-coded double action manual release station can provide this capability. The SG-32SK1 "Fire System Release" manual station is normally installed across the initiating detection zone configured to activate a solenoid releasing valve. When cross zoning is employed the device is installed on a separate zone solely dedicated to manually activate the appropriate solenoid valve.

OPERATION:
The double action station requires that the "PUSH" bar be rotated inward allowing the "PULL" handle to be pulled downward. This action breaks an acrylic break rod and closes the stations normally open switch contacts, causing the initiating zone to alarm, activating the solenoid releasing circuit. The station must be reset with a key. Insert the key and turn clockwise to unlock the station, open the front cover and return the "PULL" handle to the upright position, then re-lock the station.

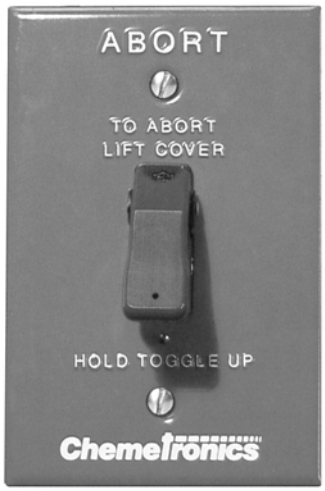
SG-32SK1

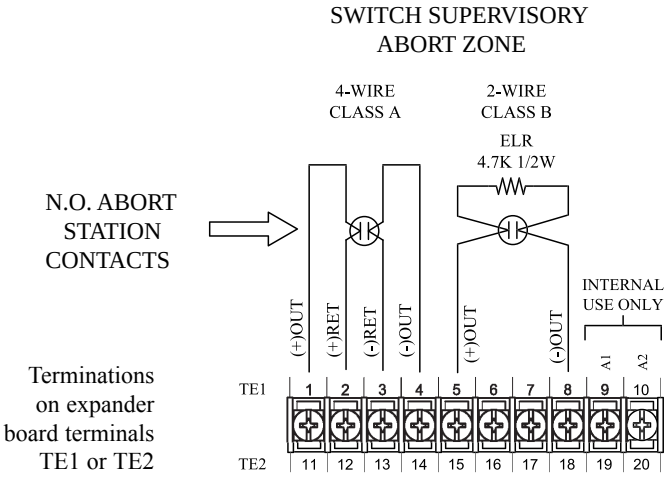


Releasing Agent Deadman Abort

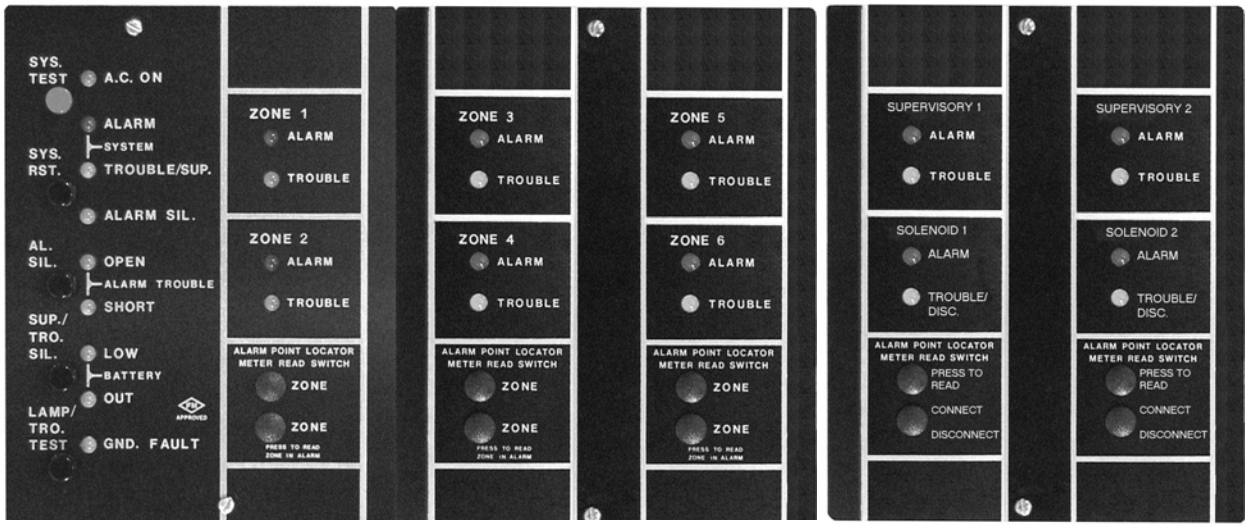
DESCRIPTION:
Some applications may necessitate the use of deadman abort stations to inhibit the release of extinguishing agents. The Chemetronics #2-010-0144 deadman abort station is designed to suit such a need. This normally open momentary switch signals the local control panel to suspend the discharge of extinguishing agents when held in the upward (initiated) position.

OPERATION:
To inhibit the solenoid activation, lift the switch guard cover and toggle the uncovered switch in the up position. This activates the *non-latching switch supervisory circuit* to an alarm state which in turn activates an abort relay in the control panel. This relay interrupts the solenoid release initiating signal. Once the switch is released the abort sequence is disengaged allowing the solenoid to activate. The supervisory circuit continuously monitors the abort switch status. If the abort switch is activated during a non-alarm system state, a system supervisory alarm is initiated (see Option "E" or "G") indicating the off normal placement of the switch. A wiring fault (open) to the abort switch is annunciated as a switch supervisory trouble condition.





FS2000 Series Fire Alarm Control Panel Instructions



Release/Sw. Supervisory Board Display

Main Board Display **Expander Board Display**

LOCAL SERVICE REPRESENTATIVE

Name:	
Address:	
Phone #:	

System Control Switches

SYS. TEST	System test button: Press and hold for a minimum of 3 seconds. This simulates an ALARM condition in all detection and supervisory zones. This test feature is applicable to systems without solenoid releasing (Option G) only.
SYS. RESET	System reset button: Press to reset system from ALARM condition.
AL. SIL.	Alarm silence button: Press to silence notification appliances activated by ALARM condition.
TRO. SIL.	Trouble/Supervisory alarm silence button: Press to silence activated common trouble signal (pulsing buzzer) or supervisory alarm signal (steady buzzer).
LAMP/TRO. TEST	Lamp and trouble test button: Press to test indicator lamps and system trouble signaling.
MS-Z#	Meter read switches: Press and hold to read distance (ft/m) to alarm actuation point of Protectowire zone in alarm. See Option A - Protectowire alarm point location meter.
AUTO/STOP/ MANUAL	Scanner mode switch: Slide switch to appropriate position for automatic scanning, stop at an individual zone or to manually step to a particular zone.
SOL.DISC.SW.	Solenoid disconnect switch: toggle to down position to inhibit solenoid activation on receipt of an alarm signal.

System Indicators

A.C. ON	Green	A.C. Power indicator: Panel AC voltage present.
SYS ALARM	Red	System alarm indicator: Activated when any zone ALARM occurs.
SYS. TRO./ SUP. SIG.	Yellow	System trouble indicator: Flashing when system TROUBLE exists. Steady when system SUPERVISORY ALARM condition exists.
AL. SIL.	Yellow	Alarm silenced indicator: Flashing when alarm notification appliance circuits are silenced.
AL. OPEN	Yellow	Alarm notification appliance circuit open indicator: On when open exists in circuit.
AL. SHORT	Yellow	Alarm notification appliance circuit short indicator: On when short exists across circuit.
BATT. LOW	Yellow	Battery low indicator: On when batteries voltage level is below allowed minimum.
BATT. OUT	Yellow	Battery out indicator: On when batteries are disconnected or above normal operating voltage.
GND. FAULT	Yellow	System ground fault indicator: On when undesirable positive or negative current leakage occurs to ground from DC power supply of system. Not available with Option H
ZONE # ALARM	Red	Zone alarm indicator: On in respect to each zones alarm condition.
	Yellow	Supervisory zone alarm indicator: On in respect to each supervisory zone alarm condition.
ZONE # TROUBLE	Yellow	Zone trouble indicator: On in respect to each zones trouble condition.
OPEN/DISC. SHORT	Yellow	Solenoid Open/Disconnected indicator: On in respect to solenoid circuit being open or disconnected.
	Yellow	Solenoid short indicator: On in respect to solenoid circuit being shorted.
BUZZER	TBZ	Trouble buzzer: Pulsing audible indication for all trouble conditions. Steady audible indication for all supervisory alarm conditions.

THESE INSTRUCTIONS MUST BE MOUNTED WITHIN THE SYSTEM ENCLOSURE OR FRAMED AND MOUNTED ADJACENT TO THE ENCLOSURE

APPENDIX A

The following Smoke Detectors/ Solenoids / Notification Appliance Circuits (NAC's) are all approved by UL for use in the FS2000 panel Unless

DET. MODEL	IDENTIFIER	BASE MODEL	IDENTIFIER
SLR-24V	HD-3	NS6-220	HB-3
SLR-24H	HD-3	NS6-220	HB-3
SIJ-24	HD-3	NS6-220	HB-3

Compatible 24 Volt Solenoids:

Solenoid	Power/ Current	FM Solenoid Group	Size NPS
ASCO MODEL: # T8210A107	16.8 WATTS, 700mA	B	1/2 in. NPS, 1/2 in orifice
ASCO MODEL:# R8210A107			
ASCO MODEL:# 8210A107			
ASCO MODEL: # 8210G207	10.6 WATTS, 440mA	D	1/2 in. NPS, 1/2 in orifice
ASCO MODEL:# HV2648571			
ASCO MODEL:# HV2648581			
SKINNER MODEL: # LV2LBX25	11 WATTS, 458mA	A	1/2 in. NPS, 1/2 in orifice
SKINNER MODEL: # 73218BN4UNLVNOC111C2	10 WATTS, 420mA	E	1/2 in. NPS, 5/8 in orifice
SKINNER MODEL:# 73212BN4TN00N0C111C2			1/2 in. orifice, 5-300 psi working pressure
SKINNER MODEL: # 73212BN4TNLVNOC322C2	22 WATTS, 920mA	F	1/2 in. orifice, 250 psi
SKINNER MODEL: # 71395SN2ENJ1NOH111C2 ***(FM APPROVED ONLY)***	10 WATTS, 420mA	G	1/4 in. NPS, 1/16 in. orifice 250 psi working pressure
VICTAULIC SERIES 753-E	8.7 WATTS, 364mA	I	1/2 in. orifice 1/2 in. NPS
VIKING MODEL: # HV-274-060-001	22.6 WATTS, 940mA	H	1/2 in. NPS, 3/4 in. orifice 250 psi
VIKING MODEL: # 11591, 11592, 11595, 11596	10 WATTS, 416mA	J	1/2 in. NPS 300 psi
VIKING MODEL: # 11601, 11602	9 WATTS, 375mA	K	1/2 in. NPS 250 psi

APPENDIX A (continued)

The following 24 Volts DC Notification Appliancel Circuits (NACs) are all UL approved for use on the FS2000 Fire Control Panel. ***Note*** Wheelock Synch module DSM-12/24-R must be used for synchronization of Horn / Strobes. *** - Indicates Field Selectable Device**

Important: ***consult manufacture cut-sheet for actual current draw***

	NAC type	Model / Series	Average Current
FEDERAL SIGNAL CORPORATION	Vibartone Horn	450	.25 Amps
	Low Profile Strobe	LP3 Series	.25 Amps
		LP6	.25 Amps
		LP1	.08 Amps
	Strobe / Buzzer Combination	AV1ST	.39 Amps
		AV1	.98 Amps
		LP7	.68 Amps
	Strobe Warning Light	131ST	1.25 Amps
		FB24STHI	.70 Amps
		FB24ST	
		FB2PST	
		FB2MST	
	Strobe Light	VALS Series	.08 Amps
Amseco	Horn	H24W	.038 Amps
		HW-24	.038 Amps
		* BZ-54VT24	.050 Amps
		HP-24 / HP-24T	.015 Amps
	DC Motor Fire Alarm Bell	MBA-6-24	.012 Amps
		MBA-8-24	.025 Amps
		MBA-10-24	.023 Amps
	Strobe Light	* SAD24-75110	.250 Amps
		* SAD24-153075	.114 Amps
		SAD24-110	.200 Amps
		* SLW24W-75110	.122 Amps
		* SLW24-153075	.087 Amps
		SL3 Series	.030 Amps
		* SLW24W-75110	.120 Amps
	Horn / Strobe Combination	* SH24W-153075	.126 Amps
		* SHP24-75110	.250 Amps
		SLB24-75	.117 Amps
		SHB24-75	.144 Amps
		* SHW24W-75110	.150 Amps
		* SHW24-153075	.098 Amps
		*SZ5424 Series	.250 Amps
	Bell / Strobe Combination	SB624-153075	.114 Amps
		SB824-153075	
		SB1024-153075	
	Speaker Strobe Combination	* SFH45-153075	.114 Amps
		* SFH47-153075	
		SFH47-110	.200 Amps
		* SFH47-75110	.250 Amps
		* SFH45-75110	.250 Amps

Continued on next page)

APPENDIX A (continued)

Important: consult manufacture cut-sheet for actual current draw
*** - Indicates Field Selectable Device**

	NAC type	Model / Series	Average Current
Amesco	Strobe Light Retrofit	* RSD24-75110	.250 Amps
		* RSD24-153075	.114 Amps
		* RSB24-153075	
		RSD24-110	.200 Amps
	Temporal Module	TMP1-3A	.025 Amps
	Synchronization Module	SMS1-3A	.009 Amps
	Conical Strobe Light	SL-5 Series	.25 Amps
Wheelock	Mini Horn	* MIZ Series	.017 Amps
	Multitone Electronic Appliance	* AMT Series	.098 Amps
	Motor Bell	MB Series	.030 Amps
	Explosion Proof Bell	CSX10 &CVX10	.500 Amps
	Strobe Light	RSSR Series	.308 Amps
	Speaker / Strobe	E70 Series	.293 Amps
		ET70 Series	.171 Amps
		E90 Series	.333 Amps
		ET90 Series	.238 Amps
	Strobe Plates	RSS Series	.333 Amps
		RSSP Series	
	Audible Strobe	* AS Series	.277 Amps
		AH Series	.047 Amps
	Chime Strobe Combination	* CH70 Series	.161 Amps
		* CH90 Series	.238 Amps
	Horn Strobe Appliance	* NS Series	.183 Amps
		* NS4 Series	.206 Amps
	Weather Proof Strobe	RSSWP Series	.102 Amps
	Weather Proof Audible Strobe	ASWP Series	.145 Amps
		AHWP Series	.041 Amps
	Weather Proof Multitone Strobe	MTWP-24 Series	.126 Amps
	Weather Proof Multitone Horn	MT-24 Series	.040 Amps
	Weather Proof Speaker Strobe	ET70WP Series	.102 Amps
	Synchronization Module	SM Series	.028 Amps
		DSM Series	.035 Amps
	Weather Proof Audible/ Visual Combo.	24V-MTWP Series	.145 Amps
	Vandal Resistant Speaker Strobe	ET-1080	.200 Amps

Note: Under a Sprinkler Supervisory Condition, the assigned Notification Appliance Circuit must have a distinct output signal from all other output notification circuits, Therefore a Temporal Module from Appendix A must be added.

Note Wheelock Synch module DSM-12/24-R must be used for synchronization of Horn / Strobes.

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